The U.S. Air Force Transformation Flight Plan

November 2003

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The U.S. Air Force Transformation Flight Plan

November 2003

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Foreword

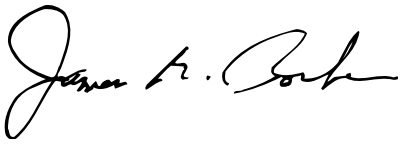
For those of us charged with protecting the United States, new national security realities have forced us to redefine our enemies as well as our concepts of defense. As we prepare to fight these new enemies, we recognize the campaigns of the future will involve all elements of our nation's might—economic, diplomatic, information, investigative, and military power—and will require us to develop new concepts of operation, technologies, and organizational constructs that will enable us to address these new challenges. It is these new challenges as well as historic opportunities to exploit revolutionary technology that underscore the absolute necessity of transforming our military capabilities.

America's armed forces must be re-balanced for future operations. What we require is a capability mix consistent with pre-defined operational concepts and effects-driven methodology. Future programs must be conceived with this mix in mind. Systems or capabilities based on arguments that do not consider the emerging joint character or the asymmetric nature of warfare will find themselves obsolete, irrelevant, and candidates for elimination.

Adapting to this new era is one of our principal missions. We view it as a process by which the military achieves and maintains advantages over our potential enemies, and enables our forces to fight and win, from a major conflict to small-scale contingencies and in every phase of a campaign. To do so, it is essential that we remain focused on how we intend to shape our force so it is poised for the future, not for the century of World Wars and Cold Wars we left behind. We need to develop strategies and concepts of operation appropriate for this new era and rethink our doctrinal approaches to organizing, training, and equipping.

The *Air Force Transformation Flight Plan* presents this Service's ongoing transformation to meet these new challenges.

John P. Jumper, General, USAF
Chief of Staff



Dr. James G. Roche
Secretary of the Air Force

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Executive Summary

The Purpose of the Air Force Transformation Flight Plan

The Air Force Transformation Flight Plan (or "Flight Plan") takes a "snapshot in time" of the ongoing transformation of the Air Force as well as anticipated future transformation. The initial Flight Plan, submitted to the Office of Force Transformation in June 2002, was developed in response to direction from the FY03 Defense Planning Guidance. This second edition addresses detailed requirements in the Transformation Planning Guidance (TPG), which are listed in Chapter I and Appendix A.

Providing Strategic Context: What Is Transformation? Why Transform?

There have been arguably two separate, but related, transformations of the US military over the past decade that will continue for the foreseeable future. **The first is the transformation from an industrial age force to an information age force.** Vast leaps in information technology in the areas of intelligence and surveillance, command and control, as well as precision kinetic and non-kinetic weapons, are dramatically reshaping warfare. Before long, joint force commanders will be able to see the entire battlespace, identify key adversary centers of gravity, and rapidly communicate that information to friendly combat forces so they can use precision munitions to destroy/affect those centers. Put another way, a commander could defeat an adversary by disabling its ability to operate as opposed to bleeding it to death with mass attrition through sequential operations or produce the effects of mass without having to mass forces (air, ground, or naval). This approach would require the deployment of fewer forces (and thus enhance rapid mobility), reduce the length of the conflict, and limit collateral damage. In seeing the entire battlespace through advanced C4ISR capabilities, a commander would also be able to identify threats and communicate that information to forces in time to avoid them. In the context of air and space operations, the keys to threat avoidance and applying the right force to the right place at the right time are the closely related concepts of **parallel warfare** and **Effects-Based Operations** (EBO).

The second ongoing transformation is that from a Cold War to a post-Cold War force. The military advantages America currently enjoys are in danger of eroding in the face of new, unique challenges in the post-Cold War security environment. The United States must prepare for new forms of terrorism, attacks on its space assets, information attacks on its networks, cruise and ballistic missile attacks on its forces and territory, and attacks by chemical, biological, radiological, nuclear, or high-explosive (CBRNE)-armed adversaries. It must also cope with the unique demands of peace operations, homeland security, urban operations, and low-intensity conflicts. To deal with this new security environment, where traditional concepts of deterrence may no longer apply, the US military must be able to conduct operations effectively across the entire spectrum of conflict against a broad range of potential adversaries.

To address both of the aforementioned realities, the Air Force has developed a definition of the transformation process to scope the efforts described in the Flight Plan:

A process by which the military achieves and maintains advantage through changes in operational concepts, organization, and/or technologies that significantly improve its warfighting capabilities or ability to meet the demands of a changing security environment.

The Air Force's Transformation Strategy

To play its part in these transformations in support of the Joint Force Commander, the Air Force is pursuing the following strategy:

- Work with the other Services, Joint Staff, and other Department of Defense (DoD) Agencies to **enhance joint warfighting**
- Continue to **aggressively pursue innovation** to lay the groundwork for transformation
- **Create flexible, agile organizations** that continually collaborate to facilitate transformation and institutionalize cultural change
- Shift from threat- and platform-centric planning and programming to **capabilities and effects-based planning and programming** via the new Air Force Concepts of Operations (CONOPS) and Capabilities Review and Risk Assessments (CRRAs)
- **Develop "transformational" capabilities** to enable the six operational goals of transformation from the 2001 Quadrennial Defense Review (QDR), the new Joint Operating Concepts (JOCs), the Air Force Vision, and the new Air Force CONOPS
- **Break out of industrial age business processes** and embrace information age thinking

To execute this strategy, the Air Force will capitalize on its three core competencies:

- **Developing Airmen:** The ultimate source of air and space combat capability resides in the men and women of the Air Force. The Service's first priority is to ensure they receive the precise education, training, and professional development necessary to provide them a quality edge second to none.
- **Integrating Operations:** The Air Force's inherent ability to envision, experiment, and ultimately execute the union of a myriad of platforms and people into a great synergistic whole is pivotal to maximizing air and space power in a joint warfighting environment.
- **Technology-to-Warfighting:** The Air Force matures and promotes its ability to translate vision into operational capabilities in order to prevail in conflict and avert technological surprise.

Enhancing Joint Warfighting

A critical part of transformation is maximizing the US military's ability to fight jointly so that the most effective force for a given situation, regardless of what Service or combination of Services contribute that force, can be brought to bear. The Services already strongly support each other in many different areas and continue to enhance that cooperation.

Maximizing the advantages of joint operations requires a common framework that enables DoD to identify Service interdependencies as well as capability gaps comprehensively. To accomplish this, the TPG established a process to create new **Joint Operating Concepts** (JOCs), which will depict how the joint force of the future is to fight across the spectrum of military operations. The JOCs are also intended to be specific enough to permit identification and prioritization of transformation requirements inside the defense program. Development of the JOCs is guided by the Joint Operations Concept (JOpsC), which captures OSD's future vision for transformed joint forces in the following "key joint force attributes": fully integrated, expeditionary, networked, decentralized, adaptable, decision superiority, and lethality.

This process of developing the JOCs and their supporting operations and integrating architectures is presently underway. Once they are completed, future Service transformation roadmaps will, as directed by the TPG, comprehensively describe how the Services are developing the capabilities necessary to execute them. The Air Force is developing Service operating concepts and a Master Capability List that support the JOpsC and the new JOCs.

Innovation to Turn Transformational Ideas into Reality

Transformation demands innovative thinking and a process that can identify, examine, and turn bright ideas into reality–whether the idea is a new technology, concept, or a novel way to organize. The objective of Air Force innovation is the timely adoption and integration of new or improved technologies, capabilities, concepts, and processes into Air Force planning and acquisition activities, organizations, and operations. Air Force innovation must be continuous and comprehensive over the near-, mid-, and far-term time horizons.

Key components of the innovation process in the Air Force include: the **Innovation panel**, **science and technology (S&T) development**, **Air Force Battlelabs**, **Advanced Technology Demonstrations**, **Advanced Concept Technology Demonstrations**, **Agile Acquisition**, **Air Force Tactical Exploitation of National Capabilities**, **experimentation**, **wargaming**, **modeling and simulation**, and **training transformation**.

Transforming Air Force Organization and Culture

Transformation is more than new hardware. Equally important, if less glamorous, are the organizational concepts that capitalize on the technological advances and allow the US military to truly transform. In addition, the process of transformation begins and ends with people. One Air Force core competency—Developing Airmen—is defined by senior leadership as the heart of combat capability. Only through the effective development of airmen and the seamless integration of their capabilities into Air Force operations can the Service optimize air and space power. To ensure its ongoing transformation, the Air Force must also modify its culture and airmen development to be conducive to transformation and then adapt its organization to institutionalize this new culture.

Key organizational transformation efforts in these areas within the Air Force:

- The **Air and Space Expeditionary Force** construct has been critical in transforming the Air Force from a threat-based, forward-deployed force designed to fight the Cold War to a capabilities-based force based primarily in the United States that is sufficiently flexible to conduct a wide range of operations throughout the world while accommodating the high operational tempo of today's contingency environment.
- US Special Operations Command has recently created a **Combat Aviation Advisory Squadron** to assist allies develop their airpower and associated combat support functional areas into a viable alternative to employing US assets. It will shape the environment and promote stability without the need to project a large US force presence abroad. The Air Force is exploring options to significantly expand and enhance this capability.
- The Air Force is transitioning into a new **Combat Wing Organization** designed to fully develop commanders with specific functional expertise to plan and execute air and space power as part of expeditionary units.
- Through the new **Force Development** construct, the Air Force has a transformed vision for how it trains, educates, promotes, and assigns the Total Force in a more deliberate, coordinated, and connected approach—one grounded in doctrine.
- Through the **Future Total Force** effort, the Air Force is continuing its transformation in the way it integrates the Air National Guard, Air Force Reserve, and civilian force to produce greater combat capability more efficiently.
- The Air Force Council has embraced a new vision and construct to **transform human capital management**.
- The Air Force is exploring various **innovative infrastructure transformation options** to increase the efficiency and effectiveness of DoD and improve jointness.
- Implementing the changes recommended by the Commission to Assess United States National Security Space Management and Organization (**"Space Commission"**) is transforming the way military space is managed and organized.
- The proposed **Warfighting Headquarters** would develop full spectrum, joint warfighting structures linked through a collaborative planning network.

Transforming to a Capabilities-Based Force

While adapting to the new strategic environment, the Air Force's principal focus has been transitioning from a platform-based garrison force to a capabilities-based expeditionary force. The Air Force is committed to make effects and the capabilities needed to achieve them the driving force behind its ongoing transformation. In the future, all Air Force operational, programming, and budget decisions will be driven by a predefined capability. To make this essential shift, the Air Force has developed **six new CONOPS: Global Mobility, Global Response, Global Strike, Homeland Security, Nuclear Response, and Space&C4ISR**. Additionally, the Integration Champion ensures the operational capabilities integrate across the other six CONOPS and that solutions from one CONOPS are applied appropriately.

The emerging CONOPS will help make this essential shift by offering solutions to a variety of complex problems warfighters can expect to encounter in the future. They focus on the essential elements required to accomplish the mission. They aim to cover the complete spectrum of warfighting capabilities and enable the Air Force to tailor forces from existing AEFs to meet the Joint Force Commander's requirements.

The Air Force is transforming around these CONOPS. In addition to serving as a roadmap for operators, the CONOPS construct will form the basis for resource allocation, future system acquisitions, and POM submissions in order to find capabilities-based solutions to satisfy warfighter requirements.

In order to precisely assess each CONOPS, the **CRRA** identifies and analyzes current and future capabilities, capabilities' shortfalls, health, risks, and opportunities. The CRRA is a twofold process: each CONOPS executes a CRRA within its effects and capability purview. Then, an Integrated CRRA assesses capabilities and capability shortfalls across all CONOPS. The CONOPS first identify desired warfighting effects and then develop top-level capabilities required to generate those effects. The CRRAs then identify capability gaps, overlaps, and robustness within each top-level capability. Finally, the Integrated CRRA identifies an acceptable level of risk and risk mitigation measures within each capability. This assessment helps the CONOPS Champions articulate any disconnects between required capabilities and programs. This provides senior Air Force leadership an operational, risk, and capabilities programmatic-based decision-making focus. Metrics to measure the Air Force's progress towards "transformation" will be derived from this analysis once the CONOPS and CRRAs have been finalized and have determined specific required capabilities. This process is transformational as it concentrates on desired battlespace effects vice specific platforms.

Developing Transformational Capabilities

The Air Force of today is facing numerous challenges in achieving the QDR's critical operational goals of transformation, the Air Force Vision, and the new Air Force CONOPS within the new security environment. Networking of air, space, and ground systems is limited. The amount and type of ISR assets needed for time-critical and simultaneous targeting in most cases is limited. Legacy air capabilities are vulnerable to the next generation of advanced air defense systems. Rapidly striking anywhere on the globe and conducting persistent operations is very difficult. In most cases, the only option to affect a target is to destroy it with kinetic weapons, which is not appropriate in all situations. Critical information and space systems are vulnerable to attack. The United States has a limited capability to affect adversary C4ISR and deny space to adversaries if necessary. In most cases, forces cannot be deployed abroad in a timely manner. American territory and forces are also highly vulnerable to ballistic and cruise missile attacks. The threat from the continued proliferation of chemical, biological, radiological, and nuclear weapons creates a continuous need to ensure that US forces can survive, fight, and win in a contaminated environment.

As previously discussed, the new Air Force CONOPS are driving Air Force requirements, both transformational and non-transformational, to ensure that the best solutions get to the warfighter. While most of the CONOPS are still in the preliminary stages of development, the Air Force anticipates that the "transformational" capabilities (based on the definition in Chapter II) they will require fall under 16 categories. These represent capabilities the Air Force cannot achieve today or that must be significantly improved to close the crucial capability gaps described above. They are organized below under the relevant Air Force distinctive capabilities from the Air Force Vision:

Information Superiority:

1. Seamless joint machine-to-machine integration of all manned, unmanned, and space systems
2. Real-time picture of the battlespace
3. Predictive Battlespace Awareness
4. Ensured use of the information domain via effective information assurance and information operations
5. Denial of effective C4ISR to adversaries via effective information operations

Air and Space Superiority: *(subdivided into three categories)*

Negating Enemy Air Defenses:

6. Penetration of advanced enemy air defenses to clear the path for follow-on joint forces
7. Effective and persistent air, space, and information operations beyond the range of enemy air defenses under adverse weather conditions

Space Superiority:

8. Protection of vital space assets
9. Denial of an adversary's access to space services

Missile Destruction in Flight:

10. Detection of ballistic and cruise missile launches and destruction of those missiles in flight

Precision Engagement:

11. Order of magnitude increase in number of targets hit per sortie
12. Achievement of specific, tailored effects on a target short of total destruction

Global Attack:

13. Rapid and precise attack of any target on the globe with persistent effects

Rapid Global Mobility:

14. Rapid establishment of air operations, an air-bridge, and movement of military capability in support of operations anywhere in the world under any conditions
15. Responsive launch and operation of new space vehicles and refueling/repair/relocation of existing vehicles

Agile Combat Support:

16. Significantly lighter, leaner, and faster combat support to enable responsive, persistent, and effective combat operations under any conditions

These are subject to change as the new CONOPS and CRRA processes mature and produce detailed analyses on the capability needs of the Air Force.

Preliminary, unclassified "lessons learned" analyses from Operation Iraqi Freedom indicate that the Air Force has achieved significant advances in many of these 16 capabilities since Operation Enduring Freedom. Key examples include: improved joint operations, Blue Force Tracking, UAVs, Time-Critical Targeting, Expeditionary Force Modules, Embedded Contingency Response Group Capability, greatly expanded special operations, unprecedented command and control, integration of space operations, and agile logistics.

The Air Force will need the assistance of and coordination with the other Services and Agencies to enable these transformational capabilities. Key areas include: joint C4ISR, information operations, joint air operations and combat air support, missile defense, space control, minimizing lift demands, joint training, joint exercises, joint experimentation, professional military education, standards by which all Services provide human resources services to employees, predictive sustainability awareness, integrated combat support situational awareness, urban operations, and homeland security.

Business Transformation

Air Force business processes stem from an industrial age when America faced a security environment that was vastly different in character than the one the Air Force faces today. Although they have been incrementally reformed and modernized over the last 30 years, the underlying philosophy and basic architecture of these processes has not changed—they are labor intensive, they lack agility, flexibility, and speed. Accountability is fragmented and diluted throughout large bureaucracies that must render their collective assent to enable the accomplishment of the most mundane tasks.

The Air Force seeks—relative to the status quo:

- A significant shift in business operations resources (dollars and people) to combat operations and new/modern combat systems
- Work processes and a work load enabling its people to accomplish routine (non-crisis, non-exercise) organizational missions within a 40 to 50 hour work week
- A compression of average process cycle time by a factor of four (relative to current established process baselines)
- An improvement in the effectiveness of operations resulting in higher customer satisfaction ratings
- Empowerment of personnel and enrichment of job functions

The Air Force has recently created several organizations, processes, and programs to begin the task of achieving these goals. Highlights include: **Business Management Modernization Program**, **Air Force Business Modernization and Systems Integration Office**, **Air Force Business Management Modernization Program**, **Business Transformation Investment Process**, and the **Balanced Scorecard**.

Long-Term Transformation

While the United States possesses a world-class Air Force, rigorous S&T is essential to maintain its superiority and better meet the security demands of an increasingly complex world into the future. In a broad sense, long-term Air Force S&T is focused on: (1) moving the Service's capabilities from a theater to a global focus; (2) integrating air, space, and information capabilities to take advantage of the synergy between these three domains; (3) rapidly projecting capability to anywhere on the Earth and into space while still retaining the ability to be expeditionary; (4) creating effects on demand anywhere, anytime; and (5) creating a rapidly composeable environment able to accurately replicate potential battlespace anywhere in the world through the use of rapid scenario generation tools—and providing that ability to the warfighters in a timely manner.

Long-term Air Force S&T is exploring many exciting possibilities, including: integrating sensory data with real-time detection; netting large arrays of sensors to create invulnerable sources of information; swarms of very small

sensors to enter tunnels, look under camouflage cover, listen behind lines, electronically eavesdrop, or sniff out chemical and biological presence or threats; nanoelectronics; nanopropulsion; molecular level sensors; a "master caution panel" for the joint commander that would proactively tap him on the shoulder whenever a new critical situation developed in the battlespace and offer alternative courses of action; bio, nano, and quantum information processing, storage, and retrieval; human performance enhancement; atomic-level computing that is a million times faster than today's silicon chip; artificial intelligence; putting a warning energy "spot" on any target worldwide that could be rapidly followed with varying levels of effects; solid-state directed energy; a safe source of fuel from water; camouflage skins; "air-launched" payloads for rapid cheap space-launch; and plasma dynamics that can significantly increase range and reduce time to target, aircraft time-on-target, and fuel consumption.

Conclusion

The Air Force is committed to transforming and maximizing joint combat capabilities. The *Air Force Transformation Flight Plan* lays out the Service's ongoing transformation efforts, which, in concert with the other Services, will help achieve the effects required by the Joint Force Commander.

The ongoing transformation of the Air Force will enable the Joint Force Commander to:

- Achieve decision cycle dominance to strike adversaries before they can mount an effective defense
- Deny sanctuary to adversaries through time-critical targeting
- Design campaign actions based on desired national security outcomes
- Use smaller forces to disable an adversary rather than having to destroy it with mass attrition
- Maximize the power, lethality, and flexibility of a truly joint force
- Successfully neutralize mobile targets
- Integrate air, space, and land systems across all Services
- Achieve Predictive Battlespace Awareness
- Deploy with significantly smaller combat support footprints
- Penetrate and defeat the next generation of advanced air defense systems to sustain air superiority into the foreseeable future
- Strike targets anywhere on the globe in a timely manner
- Affect targets short of destroying them
- Protect its information systems
- Disrupt adversary C4ISR, effectively making the enemy fight blind, deaf, and dumb
- Protect space systems and deny space to adversaries, if necessary
- Rapidly deploy forces abroad
- Defend against ballistic and cruise missile attacks
- Protect resources on the ground for forces both within the United States and abroad
- Assure continuous operations in a CBRNE environment

These capabilities will not only revolutionize high intensity combat operations, but also enable the United States to face new non-conventional threats and the future security environment. For example:

- Rapid global attack, rapid global mobility, persistent ISR, standoff, ballistic and cruise missile defense, information operations, and stealthy air defense penetration capabilities will counter various anti-access strategies by adversaries.
- Information operations capabilities will protect critical C4ISR systems and networks against adversary attacks and counter adversary PSYOP campaigns.
- Space superiority capabilities will protect critical space assets against growing adversary threats to them.
- Information superiority capabilities will counter advanced dispersal and deception techniques and enable tracking of targets under the cover of night and in adverse weather.
- Information superiority, non-lethal, and rapid global mobility capabilities will greatly enhance future urban operations.
- Rapid global attack, loitering munition, information superiority, and rapid global mobility capabilities will be essential in the ongoing global war on terrorism.
- Ballistic and cruise missile defense and force protection capabilities will protect US forces from new technologies available to adversaries and defend the US homeland.
- Agile combat support capabilities will enable US forces to conduct responsive, persistent, and effective combat operations under any conditions, to include CBRNE environments.
- Predictive Battlespace Awareness capabilities will significantly mitigate the unpredictability of threats in the new security environment.
- Information superiority, rapid global mobility, agile combat support, and rapid global attack capabilities will significantly mitigate the greatly reduced access to forward bases.

The Air Force will always excel at providing air and space focused capabilities to the joint warfighter, while enhancing the capabilities of soldiers, sailors, and marines. The diversity and flexibility of Air Force efforts and capabilities through concepts of operation, technology, and organizational structure provide unparalleled value to the Nation and make the whole team better. DoD must integrate the existing capabilities of the Services in a way that is most efficient and effective to address the rapidly changing security environment. The Air Force will continue to work with the rest of DoD to develop the new Joint Operating Concepts and keep transformation focused to provide the capabilities required for the Nation in the 21st Century.

I. Introduction

"Transformation is not a term; it is a philosophy—a predisposition to exploring adaptations of existing and new systems, doctrine, and organizations. It has been part of the Air Force for decades. Transformation is not outlining new programs or things to buy. Rather, it is an approach to developing capabilities and exploring new concepts of operation that allow us to be truly relevant in the era in which we find ourselves, and for years to come."

–Dr. James Roche, Secretary of the Air Force

To support US national security, the Services must maintain broad and sustained advantages over potential adversaries by providing joint commanders with the most effective solutions to conduct a broad spectrum of joint operations. The capabilities necessary to achieve this have, of course, changed through time, requiring the military to constantly adapt and "transform." The Air Force, like all the Services, has contributed significantly to the US military's transformation through the years. Examples of past transformational technology breakthroughs in air and space power include jet aircraft, supersonic flight, missiles, nuclear weapons, spacecraft, long-range airpower, and precision-guided munitions. Throughout its history, the Air Force has also gone through numerous significant organizational and conceptual changes to maximize the effectiveness of these new capabilities. This ongoing transformation of the US military continues today.

Purpose of the Air Force Transformation Flight Plan

The initial version of the Air Force Transformation Flight Plan (or Flight Plan), submitted to Office of the Secretary of Defense (OSD) in June 2002, addressed the requirement in the FY03 Defense Planning Guidance (DPG) to "prepare and update annually for review by the Secretary of Defense a transformation roadmap...[that will]... specify timelines to develop Service-unique capabilities necessary to meet the critical operational goals [of transformation, which are described in DPG-03 and the 2001 Quadrennial Defense Review (QDR)]" and "address resource requirements to fully fund transformation through the Future Years Defense Program [FYDP]."

This 2003 edition is governed by the OSD's Transformation Planning Guidance (TPG), signed by the Secretary of Defense in April 2003, which lays out the Department's transformation strategy and roles and responsibilities in a series of "transformation tasks" to implement that strategy. The broad outline of this transformation strategy is to:

- **Develop new joint operating concepts (JOCs)** and associated linking integrated architectures that depict how the joint force of the future is to fight to meet the objectives of the six operational goals of transformation from the 2001 QDR with enough detail to permit identification and prioritization of transformation requirements inside the defense program.
- **Have Services and Joint Forces Command (JFCOM) prepare transformation roadmaps** to specify the capabilities required by the JOCs and their supporting operations and architectures and articulate how they intend to build the capabilities necessary to execute them.
- **Initiate rapid research, development, testing, and evaluation programs** to facilitate execution of these roadmaps and stimulate alternative ways to better achieve desired capabilities without sacrificing safety of personnel, equipment, or mission.
- **Evaluate and interpret progress** toward implementation of all aspects of this transformation strategy–recommending modifications and revisions where necessary. More specifically, TPG requires the following appraisals:
  - **Strategic Transformation Appraisal** (by the Office of Force Transformation) will assist the Secretary of Defense measure progress in implementing transformation. It will include recommendations for future DPGs.
  - **Program/Budget Review Output Report** (by OSD Program Analysis and Evaluation) will summarize the transformational elements of the defense program and evaluate the transformational value of Service programs in light of their transformation roadmaps and the implementation of transformational initiatives.
  - **Roadmap/POM Analysis** (by OSD Program Analysis and Evaluation) will evaluate POMs based on their consistency with transformation roadmaps and provide recommendations for resolution of issues in the program review.

The TPG includes several statements that describe OSD's overall guidance for this and future Service transformation roadmaps:

> *"The roadmaps will demonstrate how the Services and JFCOM intend to build the capabilities necessary for executing the joint operating concepts. Upon approval, these roadmaps will be used by the Services to help develop their POMs* [Program Objective Memorandums]. *During the annual program/budget review, the transformation roadmaps will be used by Director, Program Analysis and Evaluation (PA&E) as yardsticks for evaluating the transformational value of the POMs." [TPG, page 14]*

> *"The 2003 DPG-directed roadmap efforts established a baseline assessment across DoD's* [Department of Defense's] *transformation activities. The next set of revised roadmaps will address capabilities and associated metrics to address the six transformational goals [the "QDR-6"] and the joint operating concepts. In addition, the Service roadmaps will provide a plan for building joint capabilities in support of the JOCs." [TPG, page 19]*

> *"....the Services and Joint Forces Command will build transformation roadmaps to achieve transformational capabilities (as represented in the six operational goals) in support of joint operating concepts and supporting operations. The transformation roadmaps will plot the development of capabilities necessary to support these concepts and will serve as baseline plans for achieving the desired joint operating concepts. They will outline the concrete steps organizations must take in order to field capabilities for executing joint and Service concepts." [TPG, page 29]*

> *"The updated transformation roadmaps will...describe how the organization plans to implement transformational architectures for future operating concepts, consistent with the joint operating concepts and supporting joint and service mission concepts to include: when and how capabilities will be fielded; identify critical capabilities from other Services and Agencies required for success; identify changes to organizational structure, operating concepts, doctrine, and skill sets of personnel." [TPG, page 29]*

In addition, Appendix Three of the TPG (replicated in Appendix A in the Flight Plan) mandates that the roadmaps describe Service efforts to address several specific key areas of interest to OSD (primarily interoperability, intelligence, information superiority, and experimentation) in detail.

In addition to addressing this guidance, this version of the Flight Plan updates the information presented in the initial June 2002 edition and conforms to the informal guidance from the Office of Force Transformation to:

- Remain a broad, strategic-level planning document that lays out a general plan with a rough schedule
- Not include extensive details regarding specific programs and their funding levels
- Not rehash "legacy" programs
- Build on last year's initial roadmaps rather than starting from scratch

The Flight Plan is a reporting document to OSD that is intended to reflect decisions, information, and initiatives already made and/or approved by the Air Force capability-based planning, programming, and budgeting process—unless otherwise noted. This process is described in the "*United States Air Force Strategic Planning Directive for Fiscal Years 2006-2023*."

The Flight Plan Outline

The body of the Flight Plan is a broad, strategic level overview of the ongoing transformation of the Air Force—organized around the Service's transformation strategy:

- Work with the other Services, Joint Staff, and other DoD Agencies to enhance joint warfighting
- Continue to aggressively pursue innovation to lay the groundwork for transformation
- Create flexible, agile organizations that continually collaborate to facilitate transformation and institutionalize cultural change
- Shift from threat- and platform-centric planning and programming to capabilities- and effects-based planning and programming via the new Air Force Concepts of Operation (CONOPS) and the Capabilities Review and Risk Assessments (CRRAs)
- Develop "transformational" capabilities to enable "QDR-6," JOCs, Air Force Vision, and the new Air Force CONOPS
- Break out of industrial age business processes and embrace information age thinking

Most of the information required by the TPG regarding details of Air Force efforts in specified areas and how Air Force transformation is addressing the QDR's six operational goals of transformation is included in the appendices.

More specifically:

- **Chapter I** presents the purpose, requirement for, and outline of the Flight Plan and broadly outlines the Air Force's transformation strategy.
- **Chapter II** provides the broad strategic context by presenting the Air Force's conceptual view of the ongoing transformation of the US military and why it is necessary.
- **Chapter III** summarizes the ongoing efforts to enhance joint warfighting—a critical piece of transformation. It includes discussion of how the Air Force already supports the other Services and vice-versa, the new JOCs, and how the Air Force anticipates that its ongoing transformation efforts will strongly support the JOCs when they are completed.
- **Chapter IV** discusses the innovation processes currently in place in the Air Force to ensure transformational ideas become reality—including details on Service experimentation required by the TPG.
- **Chapter V** discusses current Service-wide organizational transformation to enhance Air Force capability significantly and institutionalize a culture conducive to transformation.
- **Chapter VI** presents the Air Force's new CONOPS, which are at the heart of the Service's transformation to capabilities-based planning.
- **Chapter VII** provides a preliminary look at the "transformational" capabilities the Air Force is pursuing in order to make the QDR's six critical operational goals of transformation, the new Air Force CONOPS, and the Air Force Vision a reality. It also outlines significant gains in these capabilities achieved during Operation Iraqi Freedom as well as what the Air Force needs from the other Services to enable these capabilities.
- **Chapter VIII** lays out the Air Force's broad goals and strategy to transform its business practices.
- **Chapter IX** briefly describes the "long-term challenges" that guide long-term Air Force science and technology (S&T) efforts and offers a glimpse into a few truly "revolutionary" concepts and capabilities the Air Force is exploring over the next fifty years.
- **Chapter X** summarizes important points about Air Force transformation.

In addition, five **appendices** describe:

1. The TPG guidance governing the scope and content of the Flight Plan.
2. Most of the detailed information required by TPG regarding Service efforts in the area of information superiority—especially interoperability, intelligence, and information operations.
3. How Air Force transformation strongly supports the six "operational goals of transformation" from the 2001 QDR.
4. The Air Force programs, Advanced Concept Technology Demonstrations (ACTDs), and future system concepts listed in Chapter VII.
5. How the Air Force supports the transformation plans of the other Services.

II. Providing Strategic Context: What is Transformation?

"Transformation is thinking through the challenges of this era, adapting our forces and people to them, and then operating our services as efficiently as possible using these new realities as the barometer to gauge our success."

—Dr. James Roche, Secretary of the Air Force

"Transformation is the leveraging of our technological superiority to create an asymmetric advantage and to combat asymmetric vulnerabilities."

–General John Jumper, Chief of Staff of the Air Force

While transformational activities have occurred throughout military history, the term "transformation" in its current context is quite new and means different things to different people. Broad, vague, and/or conflicting definitions have not only resulted in confusion, but have also led to widespread misunderstandings about the military's transformation efforts. In order to determine what efforts to include in the Flight Plan and to provide an overall strategic context, the Air Force first had to define "transformation."[1]

Most discussions that attempt to describe transformation appear to fall into two general schools of thought. The first links transformation exclusively with the so-called "revolution in military affairs" (RMA) or transforming from an "industrial age" force to an "information age" force. The second views transformation more broadly in the context of transforming from a Cold War force to a post-Cold War force. This chapter briefly describes these two perspectives and the Air Force concept of transformation, which takes both into account.

[1] While the discussion in this chapter focuses on combat transformation, the concept of transformation has also been applied to the business practices of the military. An overview of those efforts in the Air Force is addressed in Chapter VIII.

Transformation as a "Revolution in Military Affairs"

A "revolution in military affairs" is widely described as a dramatic increase in combat capability that changes the rules of the game and renders the status quo obsolete. RMAs combine new revolutionary technology with organizational and conceptual changes that maximize the effectiveness and potential of that technology. RMAs are not necessarily dependent on or driven by changes in the security environment. Instead, new technological advances primarily drive them. The RMA school of thought tends to have a very strict view of what actually is "transformational," as it directly pertains to the new revolutionary technology driving the RMA and associated concepts and organizational changes.

Proponents of the RMA view of transformation assert that vast leaps in information technology in the areas of intelligence and surveillance, command and control, as well as precision kinetic and non-kinetic weapons are dramatically reshaping warfare. Before long, joint force commanders will be able to see the entire battlespace, identify key adversary centers of gravity, and rapidly communicate that information to friendly combat forces so they could employ precision munitions to destroy/affect those centers. Put another way, a commander could defeat an adversary by disabling its ability to operate as opposed to bleeding it to death with mass attrition—or produce the effects of mass without having to mass forces (air, ground, or naval). In turn, this would require the deployment of fewer forces, reduce the length of the conflict, and limit collateral damage. In addition, in seeing the entire battlespace through advanced command, control, communications, computers, intelligence, surveillance, and reconnaissance (C4ISR) capabilities, a commander would be able to identify threats and communicate that information to forces in time to avoid them.

In the context of air and space operations, the keys to threat avoidance and applying the right force to the right place at the right time are the closely related concepts of parallel warfare and Effects- Based Operations (EBO). **Parallel warfare** refers to the simultaneous attack of carefully selected targets to achieve specific effects as opposed to attacking targets in a more sequential fashion with the goal of destroying everything on a target list. Until the Gulf War, there were three primary obstacles that made parallel warfare problematic: (1) the requirement for mass to compensate for the lack of precise weaponry, (2) the high number of assets necessary to suppress enemy air defenses, and (3) the absence of an operational level concept focusing principally on effects to achieve control over an opponent rather than total destruction. The development of low-observable "stealthy" platforms, precision weapons, information operations capabilities, along with a new concept of operations (i.e., EBO), overcame these obstacles and made parallel warfare possible.

While parallel warfare is a manifestation of the ongoing RMA, **Effects-Based Operations** is a critical enabler. The central idea of EBO is to design campaign actions based on desired national security outcomes rather than merely attacking targets to destroy adversary forces. The goal is to understand the effect that is desired in the battlespace and then create that effect more efficiently and effectively. EBO may enable striking fewer targets, using fewer weapons, avoiding enemy threats, mitigating

the consequences of enemy action, and limiting the potential for collateral damage and civilian casualties that might occur from a more traditional air campaign. EBO also focuses on combining and coordinating all elements of national power, military and non-military, to achieve its goals by influencing the will and perception of the adversary's decision-makers. EBO requires systems-based intelligence analysis that reveals what an adversary relies on to exert influence and conduct operations and the ability to get that intelligence and all other relevant information to the right place at the right time. It also requires the ability to precisely conduct operations in the right order, with a wide range of tools, to include non-lethal weapons and information operations. While the tenets of EBO can be applied in every medium of warfare, the relative advantages of air and space power—speed, range, maneuver, flexibility, precision, perspective, and lethality—fit seamlessly in this strategic construct.

However, current limitations in both technology and organizational structure prevent the military from achieving the full potential of parallel warfare and EBO. Overcoming these limitations through non-lethal weapons, information operations, miniature munitions, counter-chemical, biological, radiological, nuclear, and high explosive (CBRNE), and space-based systems is a key goal of the ongoing RMA.

Transforming from a Cold War Force to a Post-Cold War Force

Another school of thought views transformation more broadly in the context of changing the US military from a Cold War force primarily designed to defend against a Warsaw Pact invasion of Western Europe and deter nuclear attack through the threat of overwhelming nuclear retaliation to a force prepared to meet the broad array of new challenges from a multitude of potential adversaries. For it, many transformational efforts that would enable the United States to deal with the new security environment may not be "revolutionary" or "transformational" as described by the RMA school. Put another way, instead of equating transformation with an RMA, this school of thought would consider the RMA to be a subset or category of transformation.

In addition, this perspective often contends that the RMA only would enable the US military to fight traditional militaries during conventional conflicts in a far more effective way while it ignores many new non-traditional/non-conventional threats, against which the RMA would have a limited impact. This new security environment has many new characteristics that require the US military to "transform":

- **Asymmetric strategies by adversaries:** Most traditional nation-states learned from the Gulf War that it would probably be fruitless to take on the United States in a conventional war. Instead, they can be expected to plan a wide array of "asymmetric" strategies to challenge the United States:
  - Various unconventional anti-access strategies to deter any US response in the first place—to include cruise and ballistic missiles and weapons of mass destruction
  - Information operations, especially network attack and psychological operations (PSYOP), terrorism, and counter-space
  - To fight not to win but rather fight not to lose in an attempt to outlast American and allied political will

  - Advanced dispersal and deception techniques that will only become more sophisticated in the future. These include hardened facilities, deception and masking (mock-ups and camouflage), urban operations, and frequent movements under the cover of night and adverse weather.
- **Non-state adversaries:** Many of America's adversaries probably will not be traditional nation-state militaries using conventional forces. Instead, they will likely be non nation-states such as terrorists, drug lords, or guerilla groups. The United States must develop new concepts of deterrence for these adversaries, for whom traditional concepts of deterrence do not apply.
- **Increased peace operations:** The need to maintain stability in failed states has greatly increased–prompting the increased demand for peace operations, which require an array of "non-conventional" capabilities.
- **New technologies available to adversaries:** Potential adversaries are also exploiting rapidly advancing technologies in deep strike and intelligence, surveillance, and reconnaissance (ISR), whose costs are declining overall, making them more accessible. The proliferation of CBRNE weapons has also made their technology and techniques more accessible. In addition, rapid advances in nanotechnology, genomics, and other advanced sciences will produce a host of potential threats in the future.
- **The diminished protection of geographic distance:** As the 11 September 2001 terrorist attacks in New York and Washington, DC graphically illustrated, the United States homeland is under significantly increased threat. Addressing this threat will require major changes both within the military and within the civilian population of the United States itself. Defending against these new threats will require greater time and perseverance than most Americans are used to enduring. Units and capabilities with primary warfighting missions could be dual-tasked to support homeland security (HLS) missions, thereby adding some level of risk to DoD's ability to conduct deployed combat operations successfully. The ability of US forces to deploy in the face of homeland attacks is an additional concern. DoD's role in homeland security must also be carefully weighed against existing national laws and policies limiting DoD's participation in domestic law enforcement and intelligence gathering.
- **Unpredictable threats:** Overall, the threats the United States faces today are somewhat unpredictable in both substance and location. America must be prepared to cope with a wide range of threats across the entire spectrum of conflict.
- **Reduced access to forward bases:** The United States has reduced access to forward bases required to conduct significant military operations. As a result, the US military is becoming more expeditionary in nature and thus will be required to carry more capability with it.
- **Nature of coalition operations is changing:** During the Cold War era, US defense planners counted on the capabilities provided by formal alliance partners in most circumstances. While those formal alliances will remain critical to future planning, recent operations have shown that the number, composition, and *ad hoc* nature of future alliances are more uncertain. Also in contrast to the Cold War, allied contributions may be, with significant exceptions, better measured in terms of political support and access to facilities than in combat capabilities.

To deal with this new security environment, this second school of thought tends to argue that the United States must refine its capabilities from a force designed only to fight high-intensity conventional battles to a force prepared to face a wide range of future contingencies across the spectrum of conflict.

Defining Transformation

Both of these views of transformation make valid points and are not mutually exclusive. Whether they constitute an actual revolution or not, rapid advances in technology are enabling significant increases in military capability that will continue to profoundly change the conduct of conventional warfare. At the same time, the security environment is dramatically different since the fall of the Soviet Union, and the US military must adapt in ways beyond the scope of the ongoing RMA to address a broad and rapidly growing array of non-conventional threats.

The TPG provides this definition of transformation: *"Transformation is a process that shapes the changing nature of military competition and cooperation through new combinations of concepts, capabilities, people, and organizations that exploit our nation's advantages and protect against our asymmetric vulnerabilities to sustain our strategic position, which helps underpin peace and stability in the world."*

The TPG adds that: *"shaping the nature of military competition ultimately means redefining standards for military success by* ***accomplishing military missions that were previously unimaginable or impossible except at prohibitive risk and cost****. The U.S. military understands current standards for success because it trains to exacting standards in the most realistic fashion possible. From this baseline, we can compare and assess new operating concepts that employ new organizational constructs, capabilities, and doctrine for achieving military objectives and determine whether they are sufficiently transformational to merit major investments.* ***Eventually such efforts will render previous ways of warfighting obsolete and change the measures of success in military operations in our favor."*** (Emphasis added) *[TPG, pp. 4-5]*

The DoD goal of transformation, according to the TPG, is to produce military forces capable of the following type of operations by the end of the decade:

- Standing joint force headquarters will conduct effects-based, adaptive planning in response to contingencies, with the objective of defeating enemy threats using networked, modular forces capable of distributed, seamlessly joint and combined operations.
- US forces will defeat the most potent of enemy anti-access and area denial capabilities through a combination of more robust contamination avoidance measures, mobile basing and priority time-critical counterforce targeting.
- US forces will leverage asymmetric advantages to the fullest extent possible, drawing upon unparalleled C4ISR capabilities that provide joint common relevant operational situational awareness of the battlespace, rapid and robust sensor-to-shooter targeting, reachback, and other necessary prerequisites for network centric warfare.
- Combined arms forces armed with superior situational awareness will maneuver more easily around the battlefield and force the enemy to mass where precision engagement capabilities may be used to maximum effect.

To more directly scope its transformation efforts, the Air Force developed the following working definition of combat transformation that addresses both perspectives on transformation while remaining consistent with the TPG's definition:

A process by which the military achieves and maintains advantage through changes in operational concepts, organization, and / or technologies that significantly improve its warfighting capabilities or ability to meet the demands of a changing security environment.

Several clarifications of the Air Force's view of combat transformation are important:

First, true transformation is not the result of a one-time improvement, but of sustained and determined effort across a broad range of areas. Each area has a starting and ending point and is at a different stage of development, but is focused on contributing to and improving the whole. The Flight Plan provides a "snapshot in time" of these areas.

Second, the Air Force believes that meaningful transformation requires integrating its expanding capabilities with those of the other Services and non-military elements of national power. Air Force transformation cannot occur in a vacuum.

Third, transformation is not just new "gee-whiz" technologies. It usually combines technology with some or all of the following:

- Adapting existing capabilities and using them in new ways
- Changes in how the military is organized that increase its effectiveness
- Changes in military doctrine and concepts of operation, to include training, tactics, techniques, and procedures that determine force deployment or determine the way forces are led or interact with each other to produce improved effects.

Fourth, it may not be possible, necessary, or desirable to transform the entire US military at once. Historically, transformations involve less than the entire force. Also, attempting to transform the entire force at once may be risky if the assumptions about the future threat turn out to be incorrect. The wrong type of force, totally incapable of meeting actual threats, may be the result.

Fifth, transformation should not be achieved at the expense of conducting current vital operations in support of the DoD Defense Strategy, maintaining adequate readiness and infrastructure, conducting critical recapitalization, and attracting and retaining quality personnel. There must be a careful balance between these requirements, which compete for limited resources.

QDR 2001 mandates a defense strategy (known as the "1-4-2-1" construct) that directs the Services to size and shape its forces to:

1 – Defend the United States
4 – Deter aggression and coercion forward in **four** critical regions
2 – Swiftly defeat aggression in **two** overlapping major conflicts....
1 – ...while preserving for the President the option to call for a decisive victory in **one** of those conflicts.

In addition to requiring the capabilities to achieve the "1-4-2-1" strategy, the QDR mandates that the United States must also be able to conduct a limited number of smaller-scale contingency operations, plus maintain sufficient force generation capability to mitigate risks. While ongoing and planned transformation efforts within the Air Force are significantly improving its ability to achieve this strategy and enabling to do so with smaller forces, it is critical that the Air Force (and other Services) maintain significant "legacy" forces in order to execute the Defense Strategy effectively and provide critical capabilities that will remain relevant into the foreseeable future.

The Air Force must also transform while continuing on or moving to a recovery path in critical areas affecting its people, including morale and quality of life. Transformation is not possible without:

- Recruiting, training, educating, and retaining a diverse mix of people who exhibit the broad skills, intelligence, and personal qualities consistent with the core values of the Air Force needed to respond to the dynamic challenges of the 21st century
- Ensuring an adequate quality of life for Air Force members and their families

Sixth, not all change is transformation. Distinguishing between transformational and non-transformational efforts, however, is difficult and at the heart of the debate over defining transformation. Transformational efforts, whether they are programs, concepts, or organization adaptation, should result in significant improvements in warfighting capabilities or the ability to address new threats. Not all efforts achieve that.

Unfortunately, there is no one quantitative metric or framework that allows us to say: "Above this line, a program, concept, or organizational change is transformational and below this line, it is not." Is a technology that gives the military five times more capability in a certain area transformational and one that provides four times more capability not transformational? This even assumes that transformational capabilities are quantifiable at all. Such metrics assume that transformation only comprises significant improvements in existing capability. This ignores the fact that many transformational efforts are geared to adapting to a post-Cold War security environment, which does not always require improvements in the same capability, but different types of capabilities altogether that are not comparable to the status quo. In the end, determining what is transformational comes down to qualitative judgment calls by informed senior leadership based on a set of agreed upon standards.

The Air Force prefers focusing on transformational *capabilities* rather than transformational programs or technologies because a new technology or program often must be combined with a new concept of operation and/or organizational change to produce a "transformational" effect or capability. The most well known historical example of this is the fact at the beginning of World War Two, the French had more

and better tanks. However, the Germans combined their tanks with a new concept and organization (*blitzkrieg*) and other new systems such as the dive-bomber to produce a transformational effect that revolutionized warfare at that time.

To determine what to include in the Flight Plan to address OSD guidance to identify ongoing efforts and relevant funding, the Air Force first developed a list of capabilities consistent with the definition and discussion of transformation in this chapter it believes are necessary to achieve the new Air Force CONOPS, QDR-6 transformation goals, and the Air Force Vision. The Air Force then identified those key new programs and future system concepts being explored that appear to be critical to enable those transformational capabilities when combined with new concepts of operation and/or organizational changes (see Chapter VII). However, it must be emphasized that these lists are preliminary and subject to change as the new CONOPS and CRRAs mature and are completed (see Chapter VI).

Seventh, transformation requires new levels of cooperation and collaboration between historically isolated communities or "tribes" within the Air Force. The speed and agility with which the Air Force must react to emerging threats means that the Service can no longer afford to sequentially move the development of new capabilities from one function to the next. The Air Force must work in parallel and constant collaboration to move promising technologies from the lab to the warfighter as quickly and efficiently as possible.

Eighth, it is important to stress that transformation is not only about changing the way the military fights. The term is also applied to changing how the military does business (see Chapter VIII) and how it works with other instruments of national power and America's allies.

III. Enhancing Joint Warfighting

"The foundation of our success [in Iraq] can be found in two simple concepts: teamwork and trust. This was a truly joint and coalition warfighting effort from planning to execution. Air, ground, maritime and space forces working together—at the same time for the same objective—not merely staying out of each other's way—but orchestrated to produce a decisive outcome."

–Dr. James Roche, Secretary of the Air Force

"It's going to get better when we understand that the buzz words of this decade [are] integration [and] persistence…We've got to learn to think in terms of integration [so that we] end up with a cursor over the target, and we are indifferent to how we got there."

–General John P. Jumper, Chief of Staff United States Air Force

A critical part of transformation is maximizing the US military's ability to fight jointly so that the most effective force for a given situation, regardless of what Service or combination of Services contribute that force, can be brought to bear. This chapter briefly describes how today's air forces support ground and naval forces and vice-versa and some key ongoing initiatives between the Air Force and the other Services that are improving joint operations. It then discusses the development of the new JOCs and outlines how the Air Force is building its concepts to support them.

The Air Force and the Joint Team

The Services already provide critical support to each other that greatly enhances the effectiveness of the joint force. For example, air power helps create the conditions for rapid Army deployment and survivable engagement:

- Air Force C4ISR assets provide theater situational awareness to the ground force commander and supports inter/intra theater communications.
- Air power provides air superiority to prevent air attacks on ground forces, lines of supply, and logistics sites.
- Air power prevents an adversary from massing armored forces, which are the most dangerous threat to dispersed ground forces.
- Air power delays, disrupts, and destroys follow-on forces.

- Air power provides persistent, all-weather fire support to light forces using new through-weather precision weapons. This allows ground forces to lighten-up and improve responsiveness by reducing pressure for early deployment or organic deep strike assets.
- Air power strikes enemy long-range strike systems, threatening ports and airfields to permit the accelerated delivery of ground forces.
- Air Force space assets provide situational awareness

Ground forces provide critical support to air power:

- Ground forces can compel enemy ground units to mass, thus providing lucrative targets for air strikes.
- Ground forces provide accurate targeting data on mobile ground forces, enabling more lethal air strikes.
- Ground forces protect key areas and bases supporting Air Force bases for fighters and ISR assets.
- Ground forces provide long-range missile fires to increase theater firepower and confront adversary with multiple threats.
- Ground forces take and hold ground.
- The Army provides significant logistics support to the Air Force.

Air Force and naval (Navy/Marines) forces are mutually reinforcing and enhance each other's effectiveness while allowing each other to focus on individual strengths. Air Forces enable naval forces in the following ways:

- Land-based air can deploy to provide presence in areas where naval forces are not available.
- Air Force can assist the Navy in countering maritime anti-access threats. For example, bombers can "takedown" large shore-based target complexes to allow naval forces to focus on other vital missions, strike mobile anti-ship cruise missile launchers to reduce the threat to the fleet, and allow aircraft carriers to deploy closer and increase sortie rates or deliver mines to bottle up enemy fleets on shore.
- Air Force can enhance the survivability of naval air power by taking down airfields with "mass precision" and/or degrade enemy surface-to-air missile (SAM) threats.
- Air Force greatly augments naval precision strike capabilities by adding tremendous punch to on-scene naval forces, providing stealth assets, enabling the joint commander to combine air and naval power to strike across the breadth of the theater, deliver large penetrating weapons against hard and deeply buried targets, and greatly enhance the ability to conduct continuous strikes around the clock.
- Air Force refueling systems increase the range and on-station times of naval aircraft.
- Air Force ISR systems provide broad theater situational awareness to naval forces.
- Air Force space assets provide situational awareness and support inter/intra theater communications.

Naval forces return the favor by assisting the Air Force in the following ways:

- Naval forces provide air forces with an enhanced ISR picture via maritime ISR assets.
- Carrier-based fighters support Air Force bomber operations and protect ISR orbits while F/A-22s deploy.
- Carrier-based electronic warfare and jamming greatly enhances Air Force survivability.
- Sea-based theater missile defense protects Air Force theater bases.
- Tomahawk Land-Attack Missiles executing Suppression of Enemy Air Defense (SEAD) missions enhances survivability of Air Force systems.
- Combined naval and air systems complicate enemy air defenses by diversifying the method, time, and geographic space of US strikes.
- The Coast Guard and Navy protect vital Air Force space assets associated with the Eastern and Western Range and associated facilities.
- Naval forces support sea launch operations and sealift requirements.
- Naval forces protect sea lines of communication needed to supply Air Force in-theater logistical requirements.

The Air Force puts a premium on joint enablers. In fiscal years 2004-2009, the Air Force will spend 23 percent of its Total Obligation Authority on joint combat forces such as close air support fighters and gunships, loitering indirect fires, and advanced air-to-ground munitions and 41 percent on critical joint force enablers such as air and space C4ISR, airlift, and tankers.

In addition, the Air Force has been working closely with the other Services to further improve joint warfighting in various areas. Some examples:

- **Air Component Coordination Element (ACCE).** During Operation Iraqi Freedom (OIF), an ACCE team was located within each component's (land, maritime, and special operations) force headquarters to allow the air component to better integrate air and space power with the operations of the other components to more fully achieve the Joint Force Commander's objectives.
- **Army-Air Force discussions on improving cooperation.** The Air Force and Army are working to improve air support of ground forces in a number of forums: Air Force Task Force Enduring Look, Air Force Doctrine Symposium III, Center for Army Lessons Learned and Air War College Lessons Learned, Joint Combat Air Support Executive Steering Committee, the Combat Air Support Summit, and the Army-Air Force Warfighter Talks. As a result, various actions were agreed upon to resolve these issues:
  - Update Joint Pub 3-09.3–Joint Tactics, Techniques, and Procedures for Close Air Support
  - Validate the Time-Phased Force Deployment Document (TPFDD) to include associated units
  - Provide Army Tactical Missile System fire support to the Joint Force Air Combat Commander
  - Provide greater support will be provided to special operations forces (SOF)
  - Develop a Joint Air Liaison Element concept
  - Improve Liaison Office manning, training, and teamwork
  - Install common, interoperable software
  - Develop a Joint Simulator requirement for combat air support

  - Strengthen joint training
  - Institute Battalion Air Liaison Officers attending the Army Battle Staff Course concept
  - Identify command and control integration and training improvements

  In addition, the two Services recently held an Army-Air Force symposium to jointly address this issue as well as urban operations and forcible entry over strategic distances.
- **Army-Air Force coordination on base protection efforts.** The Air Force is coordinating its Integrated Base Defense and Force Protection effort with the Army's Project Guardian.
- The **Improved Data Modem** will provide critical Joint Surveillance Target Attack Radar System (JSTARS) data to Army Apache attack helicopter gunships, which will dramatically reduce the kill chain timeline for air-to-ground targeting. The JSTARS mission crew will be able to provide moving target indicators directly into the cockpits of over 500 Apaches while simultaneously providing this information to the Air Operations Center over satellite communications radio.
- **Joint Unmanned Combat Aerial Vehicles (UCAV) Office.** A Joint Program Office was stood up on 1 October 2003 to address Air Force and Navy UCAV issues. Its goal is to create standards that will allow UCAVs to be built along common lines in hopes of decreasing costs while retaining interoperability.
- **Joint command and control.** As also discussed in the Joint Transformation Roadmap, the Navy, Marines, and Air Force are collaborating to synchronize development of FORCEnet and the Command and Control Constellation.
- **Joint wargames.** Air Force participation in OSD, Joint Staff, and other joint wargames explores the potential synergy of emerging joint concepts.

Working with other joint force elements, Air Force capabilities enable and accelerate joint force power projection operations in the new security environment. The mobility and swiftness, stealth, precision, and range of the Air Force, working with the dramatically enhanced capabilities of the Army, Navy, and Marines, have already paid huge dividends in recent operations.

JOC Development Process

Further expanding joint capabilities requires a detailed common framework that enables DoD to identify Service interdependencies as well as capability gaps. In order to achieve this, the TPG established a process to create new joint operating concepts, which will describe how the future joint force will fight across the range of military operations. The process will permit DoD to identify and prioritize transformation requirements inside the defense program and is the key to the DoD's transformation strategy.

The Joint Staff, in coordination with the Services and Unified Combatant Commanders, recently developed an overarching joint concept (the Joint Operations Concepts or JOpsC) that broadly describes how the joint force intends to fight in the next 15-20 years and provides the conceptual framework to guide future joint concept development and experimentation. Buttressing this effort is the development of four subordinate JOCs that address major joint force applications, which include major combat operations, stability operations, homeland security, and strategic deterrence.

Because the JOpsC and JOCs will continue to evolve as insights are gained from testing and experimentation, they should be viewed as "works in progress" until validated.

The JOpsC describes the four JOCs as follows:

- **Major Combat Operations (MCOs).** MCOs achieve objectives by removing an adversary's ability to conduct military operations and creating acceptable political conditions for the cessation of hostilities and the imposition of US will. At the direction of the President, the Joint Force will simultaneously "swiftly defeat" two efforts, and, if necessary, win one of those efforts decisively. MCOs are conducted in a campaign consisting of sequential, parallel and simultaneous actions distributed throughout the physical, information and cognitive domains of the global battlespace. Operations will attempt to sustain an increased tempo, placing continuous pressure on the adversary, and will harmonize military action with the application of other instruments of national power. The campaign is designed to dismantle an adversary's system of offense and defense, preempt their freedom of action, destroy critical capabilities and as rapidly as possible isolate enemy forces. Thereby, the joint force will deny the adversary sanctuary, the ability to maneuver and reconstitute, and defeat or destroy them through the integrated application of air, ground, maritime, space and information capabilities.
- **Stability Operations**. Stability operations are military operations in concert with the other elements of national power and multinational partners, to maintain or re-establish order and promote stability. These consist of global and regional military operations that establish, shape, maintain and refine relations with other nations. Included are operations to ensure the safety of American citizens and US interests while maintaining and improving the US ability to operate with multinational partners to deter hostile ambitions of potential aggressors. Stability operations help ensure unhindered access by the US and its allies to a global economy. These operations may include a wide array of tasks from combat operations–in order to remove isolated pockets of resistance, to peace enforcement, or security cooperation activities.
- **Homeland Security.** The highest priority of the United States is Homeland Security. The military mission sets are homeland defense, civil support and emergency preparedness. Homeland defense will be the primary focus of the Homeland Security JOC. Military forces may execute assigned missions in circumstances of emergency, routine or extraordinary nature. The mission sets for homeland defense are aerospace, land and maritime defenses. These are operationalized through attack operations, active defense, passive defense, command, control, communications, computers, and intelligence. The mission sets for civil support are military assistance to civil authorities, military support to civilian law enforcement agencies and military assistance for civil disturbances.
- **Strategic Deterrence.** Strategic deterrence encompasses the range of DoD efforts and capabilities to discourage aggression or coercion by potential adversaries. Strategic deterrence provides the President with a range of military options and capabilities intended to deter aggressors while requiring only modest reinforcement of forward-deployed and stationed forces from outside the theater. Strategic deterrence includes joint counterproliferation, defense against weapons of mass destruction, overseas presence, peacetime military engagement and nuclear and non-nuclear strike capabilities enhanced by global intelligence.

The Air Force recently provided its MCO future joint warfighting perspective in JFCOM's Pinnacle Impact '03 discovery experiment. The Air Force concept, Decisive Coercive Operations, goes beyond the current Air Force CONOPS to the 2018 timeframe and integrates joint capabilities as defined in the JOpsC. The concept rests firmly on coercion theory and attempts to prevent conflict by using decision superiority, assured access, persistent dominance, and the Warfighting Headquarters (see Chapter V) to favorably influence regional, state, and non-state actors. If conflict erupts, the concept uses mechanisms to quickly engage and bring order before events spin totally out of control. Unlike many other Service concepts, Decisive Coercive Operations is a joint approach that incorporates not only military force, but also all instruments of power to influence and bring compliance.

Once the JOCs are completed, the TPG directs the Joint Staff to generate a list of required "supporting operations" necessary to support the JOCs and develop "integrated architectures" for each supporting operation. The architectures will describe in greater detail the relationship between the tasks and activities that generate effects on enemy forces and also those tasks and activities that support functional operations. They will identify where operations intersect and overlap and provide details on interoperability requirements. The architectures will include material solutions, doctrine, organization, and training needs. Using these architectures, the Joint Requirements Oversight Council will prioritize needed capabilities based on their contribution to realizing the JOCs. The Services and selected combatant commands will then develop new concepts, or refine existing concepts, to support each joint operating concept.

How Air Force Supports Future Joint Concepts

The Air Force fully supports joint warfighting. As joint concepts are developed, to include the JOCs, Air Force concepts will follow suit to underpin and support the joint construct. The process for developing the JOCs is presently underway with an expected completion date in early 2004. Once completed, future editions of the Flight Plan will provide specific details of how the Air Force plans to field the capabilities necessary to execute the JOCs and their supporting operations and architectures (the Air Force will develop a Master Capability List that supports the JOCs).

In the meantime, the Air Force has embraced the key Joint Force Attributes in the JOpsC and is developing concepts and capabilities that support them. These attributes are:

- **Fully Integrated:** joint forces must move beyond deconfliction to fully integrated elements with all functions and capabilities focused toward a unified purpose
- **Expeditionary:** joint forces are rapidly deployable, employable, and sustainable throughout the global battlespace regardless of anti-access or area-denial environments and independent of existing infrastructure
- **Networked:** joint forces are linked and synchronized in time and purpose to turn information into immediate actions
- **Decentralized:** joint forces leverage power of interdependent joint capabilities while operating jointly at lower echelons
- **Adaptable:** joint forces can quickly respond to any contingency with the appropriate capabilities mix

- **Decision Superiority:** joint forces can arrive at better decisions that can be implemented faster than an adversary can react or at a tempo that allows the force to shape the situation or react to changes and accomplish its mission
- **Lethality:** joint forces can destroy an adversary and its systems in all conditions and environments via kinetic and non-kinetic means while leveraging technological advances in great precision and more devastating target effects at both longer ranges and in close combat

Using these attributes, the following table identifies how Air Force concept and capability development efforts described in the Flight Plan link to future joint force operations. It is important to underscore that there are many additional capabilities and efforts throughout the Air Force not included in the Flight Plan that would also contribute to these Joint Force Attributes.

Joint Force Attributes (from JOpsC)	Relevant Air Force CONOPS (Chapter VI)	Relevant Air Force Transformational Capabilities (Chapter VII)	Other Relevant Air Force Efforts in the Flight Plan
Fully Integrated	Space&C4ISR	Information Superiority	Interoperability (Appendix B), Command and Control (Chap IX), Business Transformation (Chap VIII), Space Commission Implementation (Chap V), Enhancing Joint Warfighting (Chap III)
Expeditionary	Global Mobility	Rapid Global Mobility, Agile Combat Support	Effective Air and Space Persistence; Rapid Air and Space Response; Sanctuary (all Chap IX); Business Transformation (Chap VIII), Air and Space Expeditionary Force (Chap V), Combat Wing Organization (Chap V), Combat Aviation Advisory Squadron (Chap V)
Networked	Space&C4ISR	Information Superiority	Interoperability (Appendix B), Command and Control (Chap IX), Space Commission Implementation (Chap V)
Decentralized	Space&C4ISR	Information Superiority	Interoperability (Appendix B), Command and Control (Chap IX), Space Commission Implementation (Chap V)
Adaptable	All	Rapid Global Mobility, Agile Combat Support	Air and Space Expeditionary Force, Future Total Force (Chap V); Effective Air and Space Persistence (Chap IX); Rapid Air and Space Response (Chap IX); Sanctuary (Chap IX); Business Transformation (Chap VIII); Combat Wing Organization (Chap V)
Decision Superiority	Space&C4ISR, Global Strike, Global Response, Global Mobility	Information Superiority	Interoperability and Information Operations (Appendix B), Finding and Tracking (Chap IX), Command and Control (Chap IX), Controlled Effects (Chap IX), Space Commission Implementation (Chap V)
Lethality	Global Response, Global Strike, Nuclear Response	Air and Space Superiority, Precision Engagement, Global Attack	Controlled Effects, Sanctuary (both Chap IX)

TABLE 1: How Air Force Transformation Supports the JOpsC Joint Force Attributes

In addition, based on the general descriptions of the JOCs from the JOpsC above, the Air Force believes its 16 transformational capabilities detailed in Chapter VII will strongly support the JOCs–as detailed in the table below.

Air Force Transformational Capability (see Chapter VII)	Major Combat Operations	Stability Operations	Strategic Deterrence	Homeland Security
Seamless joint machine-to-machine integration of all manned, unmanned, and space systems	X	X	X	X
Real-time picture of the battlespace	X	X	X	X
Predictive Battlespace Awareness	X	X	X	X
Ensured use of the information domain via effective information assurance and IO	X	X	X	X
Denial of effective C4ISR to adversaries via effective IO	X	X	X	X
Penetration of advanced enemy air defenses to clear the path for follow-on joint forces	X		X	
Effective and persistent air, space, and information operations beyond the range of enemy air defenses under adverse weather conditions, twenty-four hours a day, seven days a week	X		X	
Protection of vital space assets	X	X	X	X
Denial of an adversary's access to space services	X	X	X	X
Detection of ballistic and cruise missile launches and destruction of those missiles in flight	X	X	X	X
Order of magnitude increase in number of targets attacked per sortie	X	X	X	
Achievement of specific, tailored effects on a target short of total destruction	X	X	X	
Rapid and precise attack of any target on the globe with persistent effects	X	X	X	X
Rapid establishment of air operations, an air-bridge, and movement of military capability in support of operations anywhere in the world under any conditions	X	X	X	X
Responsive launch and operation of new space vehicles and refueling/repair/relocation of existing vehicles.	X	X	X	X
Significantly lighter, leaner, and faster combat support to enable responsive, persistent, and effective combat operations under any conditions	X	X	X	X

TABLE 2: How Air Force "Transformational Capabilities" Support JOCs

IV. Innovation: Turning Transformational Ideas into Reality

"It is our strength that we unlock the intellectual potential that resides in those who can think across the dimensions of air and space, of manned and unmanned. If we can do this, it is true transformation."

–General John Jumper, Chief of Staff of the Air Force

Transformation demands innovative thinking and processes that can identify, examine, and turn bright ideas into reality–whether it is a new technology, concept, or a new way to organize. This is a key part of the Air Force core competency of turning vision into tools for the warfighter. The purpose of Air Force innovation is to rapidly assess and implement new ideas, concepts, and technologies to field the best capabilities to the warfighter while also improving the associated doctrine, organization, training, materiel, leadership and education, personnel, and facilities (DOTMLPF). Air Force innovation must be continuous and comprehensive as the Service moves into the future.

Sources of Air Force innovation are numerous and come from senior leadership all the way down to junior airmen. They come from within the Air Staff, the Secretariat, Major Commands (MAJCOMs), operational units, support organizations, professional military education, academia, S&T research, and the entire defense community. Specific programs often come from lessons learned following combat operations, where a need for a certain capability or effect was crucial but not available.

Before discussing the specific details of Air Force transformation in the remainder of the Flight Plan, this chapter briefly discusses the processes the Service uses to conceive and examine new ideas and turn them into reality.

The Innovation Panel

Whether a management or operational concept or a new system, it is essential that an advocate champion bright ideas to ensure transformation occurs. The Innovation Panel performs this role by supporting the corporate resource allocation process within defined Air Force mission and mission support areas. Its portfolio is a subset of program elements, programs, and activities such as Battlelabs and S&T that drive, enable, or enhance Air Force innovation. The Innovation Panel examines insights into the various elements of its portfolio to generate Air Force-wide assessments and advice.

Science and Technology Development

The **Air Force Research Laboratory and product centers** support the innovation process with emerging technologies. The laboratory works closely with operators and strategic planners to link research activities with the Air Force's distinctive capabilities and future concepts of operation. Six long-term challenges have been identified to focus Air Force efforts. The challenges are: finding and tracking, command and control, controlled effects, sanctuary, rapid air and space response, and effective air and space persistence. S&T development will also identify solutions that improve or enhance the Service's ability to provide Agile Combat Support to the warfighter, such as reducing the deployment footprint and improving asset visibility and logistics command and control. Long-term S&T efforts are outlined in more detail in Chapter IX. The Air Force also maintains a close working relationship with various laboratories, civilian industry, and government agencies.

Air Force Battlelabs

The Battlelab's mission is to rapidly identify and prove the worth of innovative ideas that improve the ability of the Air Force to execute its distinctive capabilities and joint warfighting. The overarching objective of Battlelabs is to generate high pay-off initiatives with minimum cost and investment. Their output includes operations and logistics concepts whose worth has been proven, creating opportunities for the Air Force to impact organization, doctrine, training, requirements, or acquisitions. Battlelabs focus on near-term solutions (2-4 years) to operational issues. The Battlelabs are aimed at Air Force distinctive capabilities, both institutionally and operationally. Leveraging ongoing training and exercise investments, the Battlelabs have a direct need for awareness and insight into all of the Air Force Warfare Center's activities. In addition, Battlelabs identify ideas by interacting with Active, Guard, and Reserve forces; foreign military services; other operational and research agencies; and industry involved in operations, training, research, testing, acquisition, and logistics. The Battlelabs' ability to freely interact with these agencies is critical to achieve its mission. The Battlelabs draw upon the expertise and resources of Air Force Materiel Command, Air Force Operational Test and Evaluation Center, Air Education and Training Command, and other organizations to rapidly generate, lend, or lease technical capabilities needed to demonstrate and measure the worth of promising operational concepts.

Advanced Technology Demonstrations (ATDs)

ATDs typically are integrated demonstrations conducted to demonstrate the feasibility and maturity of an emerging technology for both Service and joint use. They provide a relatively low-cost approach for assessing technical risks and uncertainties associated with critical technologies prior to incorporating these technologies into a system entering the formal acquisition process. ATDs are selected by the Applied Technology Council consisting of the commander of the laboratory, commander of the product center, and the vice commander of the client MAJCOM. This selection process ensures the ATDs are focused on solutions that will facilitate a MAJCOM in achieving its mission. ATDs are managed and executed by the Air Force Research Laboratory.

Advanced Concept Technology Demonstrations (ACTDs)

ACTDs are designed to respond quickly to an urgent joint or Service military need. They employ available technologies, which frequently have been successfully demonstrated in an ATD. Under ACTDs, systems are designed, fabricated, and then demonstrated in realistic combat exercises to gain an understanding of the military utility of the system, to support development of the associated CONOPS, and to place a limited but demonstrated capability into the hands of the warfighter at the conclusion of the ACTD without jeopardizing the warfighter's safety or effectiveness. The Air Force leads several current ACTDs likely to play a significant role in providing transformational capabilities. They are discussed in Chapter VII and Appendix D.

Agile Acquisition

Developing and fielding weapon systems in today's dynamic threat environment with rapidly evolving technologies demands changes to the process the Air Force uses to acquire those systems. Agile Acquisition is changing the way the Air Force delivers capability to the warfighter with two basic goals: decrease acquisition cycle time and increase credibility in executing programs. The bottom line is to achieve effects on the battlefield with today's technology today rather than yesterday's technology tomorrow. Achieving this aim requires collaboration among all the stakeholders in the acquisition process to include the warfighter, funding, engineering, test, S&T, program management, industry, contracting, sustainment, and others.

The Air Force and DoD began this transformation with complete revisions to the directives governing acquisition. The governing principles include encouraging innovation and flexibility, permitting greater judgment in the employment of acquisition principles, focusing on outcomes vice process, and empowering program managers to use the system versus being hampered by over-regulation. Development and delivery of integrated capabilities requires the flexibility to use innovative approaches such as evolutionary acquisition where capability is delivered to the field incrementally. The warfighter gets products delivered quickly, and the acquisition team has the opportunity to infuse emerging technology into the system and deliver full capability.

The next steps in Agile Acquisition include developing a collaborative requirements process, a seamless verification process, and a focused technology process. First, a collaborative requirements process will demand that the warfighter, acquirer, and tester work as one team at the outset and throughout the development or a weapon system. It is imperative to begin with a CONOPS and then define requirements, with the engineers and scientists helping the team understand the risks and the cost drivers of the current and/or evolving technology. Second, a seamless verification process will necessitate the merger of developmental and operational tests into complementary, synergistic activities. Third, a focused technology process will target limited science and technology resources on programs that directly support warfighter capability needs. Collaboration with the science and technology community will bring more mature technologies into programs, adding to capabilities and avoiding delays.

Credibility is the key to Agile Acquisition. A collaborative approach between warfighters and acquirers in continuously performing risk management will be essential. Written agreements have been reached between the acquisition and requirements communities to continually engage in expectations management so that users and acquirers will remain in sync on all cost, schedule, and performance issues and program surprises will be reduced. Eventually, risks will drive cost, schedule, and performance tradeoffs. Collaboration is essential to tradeoff non-critical elements in the program and buy down risk.

Air Force Tactical Exploitation of National Capabilities (TENCAP)

The Air Force TENCAP mission is to increase warfighter awareness and tactical use of national and other space systems through rapid prototyping and assisting in the identification and definition of possible warfighter application of emerging technologies and concepts. Air Force TENCAP is a non-traditional acquisition program that rapidly prototypes projects, validates proofs of concepts, and demonstrates capabilities and transitions them to the warfighter or to an appropriate System Program Office for further development and fielding within the operating forces. Air Force TENCAP also influences the development of emerging technologies for tactical users by providing inputs into the capabilities and development cycle of national, military, commercial, and civil space systems. Air Force TENCAP executes this portion of the charter through coordination and participation in the development process for future systems with laboratories and agencies. A final mission area is the education and training of operational forces in emerging technologies and concepts developed by Air Force TENCAP. A critical need exists to properly educate the provider on required warfighter capabilities as well as the environment of the operational user. Air Force TENCAP executes this portion of the charter by participating in combat or contingency operations, exercises, and project demonstrations worldwide.

Experimentation

Air Force experimentation is a discovery process that facilitates achieving the Air Force Vision; identifies innovative and revolutionary operations and logistics concepts; evaluates the concepts and associated capabilities; and provides feedback through the operational innovation process and into the Air Force Corporate Structure.

The remainder of this section addresses TPG guidance for the Service transformation roadmaps to describe how Service experimentation programs meet the TPG experimentation criteria (in bold below) and support OSD priorities for experimentation.

Scientific method and its role in US armed forces achieving competitive advantages: The Air Force uses the Scientific Method in its experimentation process, using the research question of whether the technology or process has operational utility to warrant fielding.

Experimentation in exercises and operations and considerations for design, data collection, analysis, and sharing results: The incentive for participation in capability-based experimentation is the possibility of securing funding to actually field the capability and, thus, significantly improve warfighting. The focus on experimentation is on near- to mid-term solutions to operational issues and a look at a larger solution scope than the Battlelabs. The Air Force conducts a variety of events and activities to investigate future operational concepts and desired operational capabilities. It also participates in large-scale field exercises and in both small- and large-scale field experiments, such as Joint Expeditionary Force Experiment (JEFX). Prototyping of capabilities occurs in limited objective experiments or in a series of spirals leading up to the main event.

Experimenting with virtual capabilities and threats to explore mid- and far-term transformational possibilities and experimentation with aggressive threats that include asymmetric capabilities, the possibility of technological breakthroughs, and span a variety of environments: As part of JEFX experiments, live-fly execution is conducted to validate the operational usefulness of experimental capabilities in a realistic environment. The Air Force leverages existing live-fly infrastructure at Nellis AFB, Nevada to execute the experiments in an efficient and safe manner and to combine live-fly, virtual, and constructive forces in an operationally realistic environment. JEFX applies air and space power in new and innovative ways to enhance Air Force distinctive capabilities and assess the operational utility of new concepts and capabilities. Virtual simulations such as Airborne Laser, F-35, and other futuristic capabilities can be part of JEFX modeling and simulation architecture, as required, to support desired scenarios. In addition, the Air Force CRRA process (described at the end of Chapter VI) includes extensive virtual capability experimentation to help decide what kind of capabilities, transformational or not, are required to achieve Air Force capabilities into the future.

The use of red teams supported with fenced funding and operating at the tactical, operational, and strategic levels: Futuristic threats such as advanced SAMs and space and information operations (IO) capabilities, including red teaming, are incorporated into modeling and simulation and scenarios to explore and define future requirements.

Institute procedures and establish repositories for capturing and sharing lessons learned: After each JEFX, the Air Force Experimentation Office publishes a JEFX Final Report and Final Briefing that captures the experiment lessons learned. Significant lessons learned are submitted to the Air Force Center for Knowledge Sharing and Lessons Learned in the Joint Universal Lessons Learned System format. The capabilities that perform successfully compete for JEFX Transition Funding and Warfighter Rapid Acquisition Program monies to get these capabilities out to the warfighter. For instance, the Master Air Attack Plan Toolkit participated in JEFX 02, was fielded, and aided the Air and Space Operations Center during OIF. Experimentation also supports requirements, acquisition, training and education programs, and the strategic planning process. Experimentation results, or findings, consist of the best "value added" recommendations for changes in DOTMLPF required to achieve the Air Force Vision. Experimentation results illuminate and underpin corporate Air Force

modernization decisions. The Air Force experimentation effort also leverages concepts and analyses from unified command, joint, DoD, Agency, coalition, and private sector experimentation and exercise programs for its planned, completed, and future events. For example, the Air Force experimented with its concept of Global Strike for the first time in JFCOM's Millennium Challenge 2002.

Consider the use of the Paul Revere concept in JEFX 02: Paul Revere is a Boeing 707 aircraft used in a concept and technology demonstrator configured to demonstrate capabilities like wideband line-of-sight technologies in support of forward elements of Find, Fix, Track, Target, Engage, and Assess kill chain prosecution. Paul Revere was outfitted with commercial-off-the-shelf equipment and Air Force systems including Intelligence, Surveillance, and Reconnaissance-Manager, Theater Battle Management Core System, Automated Application for Intelligence Preparation of the Battlespace, Joint Services Work Station, Information Work Space, and Automated Deep Operations Coordination System. All battlefield information was displayed on 24 real-time reconfigurable operator workstations integrated into a wideband aircraft network linked to the ground via a line-of-sight tactical common data link. This demonstration and experimentation with emerging technologies allowed Air Force planners to close the seams between the operational and tactical levels of war with direct application to the recent Iraqi conflict.

Wargaming

Air Force wargames explore emerging and future operational concepts, capabilities and doctrine to evaluate the Service's Strategic Plan and Vision and refine the Air Force Capabilities Investment Strategy in order to determine how air and space power can better support the joint commander and integrate with the other Services.

In addition to conducting its own wargames, the Air Force also participates in other Service, OSD, and joint wargames. Air Force participation in the Army and Navy Title 10 wargames provides an excellent forum to highlight Air Force transformation initiatives and to examine how modern air and space power contributes to joint operations. Similarly, Air Force participation in OSD, Joint Staff, and other joint wargames explores the potential synergy of emerging joint concepts. Examples of Air Force participation in OSD/joint games include Pinnacle Impact, which is sponsored by JFCOM, the OSD Transformation Wargame series, and several other JFCOM wargaming events. Finally, there are several interagency efforts at varying classification levels that further augment and integrate the unclassified games. Wargame scenarios, concepts, and capabilities are conducted in future timeframes.

To ensure that wargame players and other interested parties are on the "same sheet of music," the Air Force maintains the "Air Force Toolbox," a web-based database outlining the characteristics and capabilities of both current and future Air Force systems. The Air Force is also exploring ways to strengthen the linkages between wargaming and Air Force/joint experimentation.

Recognizing the uncertain environment in which future airmen may find themselves, the Air Force Chief of Staff directed that a recurring Air Force wargame, Global Engagement, explore emerging operational concepts and warfighting issues for employment of air and space power. Global Engagement examines the comprehensive application of air and space power to the joint fight beyond the current POM year. This game seeks to examine the totality of modern warfare on a level playing field. In a structured forum, military and policy experts highlight, discuss, explore, and define warfighting concepts and issues that can shape the future Air Force.

To explore potentially transformational concepts more than fifteen years beyond the current POM year, the Air Force utilizes the Future Capabilities Game. Set approximately a decade beyond Global Engagement, the Future Capabilities Game explores alternative futures and force structures to support strategic planning inputs. The Future Capabilities Game works within the context of the Administration's guidance and strategy to determine the Air Force capabilities most useful to the future joint force commander. Proponents of new concepts, capabilities, and emerging doctrine include these innovations in the wargames to explore their future potential and raise their visibility. Both Global Engagement and the Future Capabilities Game incorporate all six operational goals of transformation from the QDR in their play. Both games are played in a joint warfighting context using game players from OSD, the other Services, and other joint organizations.

Space wargames bring together leaders and planners from the Services, the intelligence community, commercial space providers, and departments, agencies, and offices to explore the in-depth integration of space into the joint fight. These wargames explore space warfare issues in detail. They examine mission partner equities as Executive Agent for Space; generate insights for Air Force Space Command, Headquarters Air Force, and DoD transformation; and provide cadre- building by bringing together the best strategic and operational minds to focus on the future of space power.

The Air Force also participates in the Focused Logistics Wargame, which facilitates assessments of new technology, current and proposed joint logistics doctrine, and current and new Desired Operational Capabilities required to meet Joint Vision 2020 Focused Logistics Challenges. The game's objective is to conduct joint logistics capability assessments over the full spectrum of operations and to debate and resolve issues affecting future combat support capabilities.

Modeling and Simulation (M&S)

The Air Force is working in conjunction with Joint Forces Command and the other Services to continue to improve modeling and simulation abilities to best serve the joint commander. The increased sophistication and robustness of modeling and simulation is enabling the creation of trade space for transformation in a low threat, yet realistic environment. The key for this to continue will be the development of a joint synthetic environment that allows for Rapid Scenario Generation for various theatres of operations. Such scenario generation will allow for mission rehearsal, new capabilities testing, and Course of Action Development in a Distributed Mission Operations environment.

Creating a **Joint Synthetic Battlespace** will allow DoD to train tailored forces for any scenario imaginable. Using **Distributed Mission Operations**, forces can be selected to meet national objectives and train together in a live, virtual, and constructive forum through the entire chain of command in a realistic and meaningful way. This capability will allow commanders the ability to test strategies and tactics in a way that is not possible today. The Air Force is expanding the Distributed Mission Operations and **Distributed Mission Training** initiative to allow commanders to train forces with a realistic mix of capabilities from the strategic level (joint battle staffs) to the tactical level (individual sorties). Distributed Mission Operations is a concept that integrates live, virtual, and constructive aspects into a single seamless joint/coalition training environment. Through simulation, assets that are seldom available live can be incorporated into a live exercise and/or rehearsal. Connectivity to the Global Information Grid will allow Low Density/High Demand (LD/HD) assets to participate in training, exercises, or mission operations even when those assets are not available in the area of operation.

For example, a JSTARS simulator located at Warner Robins Air Force Base might be "connected" to a Red Flag strike package so that the JSTARS is a seamless part of the live-fly operation. In other words, the same JSTARS sensor information is available to the exercise participants that would be available had the E-8 been located in an orbit supporting the Red Flag shooters. Expanding from the JSTARS-Red Flag example enables the Air Force to visualize a capability to practice missions requiring a "total team" environment where all the players and command and control are part of a realistic "virtual" battlespace where it is impossible to determine if a particular input comes from a live or virtual source.

To attain the Distributed Mission Operations vision, the Air Force has established three goals:

- Integrate and access war-altering capabilities across compartments and stovepipes before a crisis and judge the value to combat actions
- Provide a force seasoned to fight as if they had been in combat in that battlespace before
- Anticipate and counter enemy actions by achieving information superiority and Predictive Battlespace Awareness (PBA) through improved decision support

In addition, the Air Force is using the DoD concept of **Advanced Distributed Simulation** as a tool to create an integrated Air and Space Warfighting M&S architecture that includes a totally interoperable Joint Synthetic Battlespace. The Air Force M&S architecture will support analysis and training by linking together many types of simulations, from aggregate and detailed computer models to pilots in live aircraft and simulators to hardware components.

The Joint Synthetic Battlespace will be a vehicle to develop future forces, concepts, systems, and doctrine in a simulated environment where Air Force roles and missions will be appropriately and accurately represented. The Air Force integrated M&S system will be manned and supported by experts and will represent the joint environment. It will also be affordable and efficient through reusable simulations with plug and play modules that have interoperability with joint, Service, and civilian environments.

Training Transformation

Training is integral to Air Force core competencies and the critical enabler for military capabilities. The Air Force is engaged with the other Services, unified commands, and OSD in developing and implementing a training transformation plan. The objective is to train as the Air Force will fight and increase the joint context of exercises through live, virtual, distributed, and constructive environments. This involves not only modernizing the integration of space and information operations in training ranges, but also planning for their sustainment to meet future test and training missions while implementing environmentally sound use and management to ensure long term availability. Future training will also likely include an increased emphasis on close air support, special operations forces, urban operations, joint/coalition command and control, and sensor training.

In addition to the Distributed Mission Operations and Distributed Mission Training initiatives described earlier, the **Live, Virtual, and Constructive Training Capability** will enhance the kill chain by allowing the sensor-shooter links training time that is currently not available to due the LD/HD realities of the C4ISR assets. Linking of the three disparate environments improves both training availability and training value while increasing commander's understanding of linkages within the kill chain. The realism achieved by this capability will further augment the commander's desire to "be inside the opponent's decision loop" and improve combat effectiveness.

V. Transforming Air Force Culture and Organization

New aircraft, advanced weapons, and an endless variety of technologically advanced gadgets gain a great deal of attention, but they are by no means the beginning or the end of the transformation effort. Equally important, if less glamorous, are the organizational concepts that capitalize on the technological advances and allow the Air Force to transform. In addition, the process of transformation begins and ends with people. One of the Air Force's primary core competencies—Developing Airmen—is defined by its senior leadership as the heart of combat capability. Only through the effective development of airmen and the seamless integration of their capabilities into Air Force operations can the Service optimize air and space power. To ensure its ongoing transformation, the Air Force must also modify its culture and the development of airmen to be conducive to transformation and then adapt its organization to institutionalize this new culture. This chapter describes key organizational transformation efforts within the Air Force in these areas.

Air and Space Expeditionary Force (AEF)

Despite a thirty percent reduction in manpower over the past twelve years, the Air Force has faced an exponential increase in worldwide taskings. This required significant changes in the way the Air Force trains, organizes, and deploys to support Joint Force Commander requirements. The AEF construct has been critical in transforming the Air Force from a threat-based, forward-deployed force designed to fight the Cold War to a capabilities-based force based primarily in the United States that is sufficiently flexible to conduct a wide range of operations throughout the world while accommodating the high operational tempo of today's contingency environment. It has also been essential in creating a mindset that embraces the unique characteristics of air and space power—range, speed, flexibility, and precision.

This construct divides most Air Force Combat Air Forces and Expeditionary Combat Support resources evenly across five AEF pairs (for a total of ten AEFs). Each of the AEF pairs also includes some associated Mobility Air Forces and Low Density/High Demand resources. In addition to the forces assigned to a particular AEF, the AEF calls upon enabling forces such as Stealth, Space, ISR, on-call bomber elements, and other LD/HD assets to provide combatant commanders with tailored forces possessing the capabilities required to execute the mission. The 10 AEFs (or five AEF pairs) are the mechanism through which the Air Force allocates available forces to meet the combatant commander requirements for rotational forces. Each AEF pair represents the Air Force capability to maintain a sustainable rotation of forces without surging. AEF rotational forces and forward permanent-based forces underpin the Air Force policy for providing global AEF presence.

The AEF incorporates a 15-month cycle during which two AEFs are designated as lead for a 90-day "eligibility" period. During this period, the two AEFs are either deployed or on alert for daily, worldwide expeditionary taskings. The remaining eight AEFs are simultaneously in various stages of reconstitution, training, or preparatory spin-up. Additionally, there is one Air Expeditionary Task Force (AETF 07) permanently forward deployed in the Republic of Korea. Forces for this AETF are sourced from the 10 AEF structure. Other AETFs are pre-designated and, when activated, will be sourced from the alert AEF pair. While Air Force combat forces cycle through deployment vulnerability periods, they sustain wartime readiness throughout the 15-month training and preparation cycle. The AEF cycle thus precludes the need for "tiered" readiness by allowing Air Force combat forces to remain current and capable for any contingency or operational plan. The first AEF cycle began on 1 October 1999 and lasted through 30 November 2000.

While ensuring necessary Air Force support for the Joint Force Commander, AEF cycles allow the Air Force and the Joint Force Commander a more predictable and stable environment in which to train, re-fit, and equip. In addition, AEF scheduling makes it easier and more feasible for the Air Force Reserve Component forces to bring their essential contributions to bear by allowing them to plan definitive absences from their civilian employment. This is a critical advantage of the AEF, as Air Reserve Component forces comprise nearly half of the forces assigned to AEFs and contribute the majority of forces for some mission areas.

Combat Aviation Advisory Squadrons

Theater strategies aimed at shaping the battlefield prior to the onset of crisis or war will be increasingly important as future battlefields become multinational with nontraditional coalition partners. US Special Operations Command has recently created a combat aviation advisory squadron to assist allies develop their airpower and associated combat support functional areas into a viable alternative to employing US assets. Combat Aviation Advisors play a major forward presence and engagement role by shaping foreign aviation forces capabilities to develop their own internal defense capabilities and integrate them as key team players for coalition operations. They also assist US combatant commanders and civilian agencies in planning and integrating foreign aviation forces into theater campaign plans, contingencies, and other joint and multinational activities. These enhanced organic, regional airpower capabilities will add stability and thereby shape the environment and promote stability without the need to project a large US force presence abroad. They also may possibly provide US access to bases if a crisis develops in the region. The Air Force is exploring options to significantly expand and enhance this initiative.

Combat Wing Organization

Based on lessons gleaned from expeditionary operations over recent decades, the Air Force created the Combat Wing Organization. The new wing organization allows commanders to fully develop within specific functional areas to plan and execute air and space power as part of expeditionary units, while also giving maintenance and support personnel focused career progression.

The new Combat Wing Organization establishes the Operations, Maintenance, Mission Support and Medical Groups. One of the key changes is the re-establishment of the Maintenance Group to focus effective use of maintenance resources. Another change is the Mission Support Group, that merges former support and logistics readiness groups and contracting and aerial port squadrons, as applicable. Within this group, the Air Force will hone expeditionary skills; to include personnel and logistics readiness, force protection, communications, contracting actions, bare base preparation, munitions and fuels site planning, and contingency beddown; and work with the joint system for load planning and deployment. Currently, all of these aspects exist in skill sets that no Air Force officer has in total. The new expeditionary support discipline will address this deficiency and provide Air Force officers the expertise in all aspects of commanding expeditionary operation. With this reorganization, each wing will now have one individual responsible for the full range of deployment and employment tasks–the Mission Support Group Commander.

This restructuring will retain the Operations Group. However, group commanders will become more active in the operational level of war. Squadron commanders will be role models for operators in the wings, ready to lead the first exercise and combat missions. Similarly, the Air Force will establish a maintenance group responsible for base-level weapons system maintenance and sortie- production rates. Like their operator counterparts, maintenance squadron and group commanders will be role models for all wing maintainers. As part of on-going medical transformation efforts, the Air Force will also develop options for consideration to enhance health service support.

Force Development

Transforming the Air Force is not possible without a process to educate, train, and offer experience to the right mix of Active Duty, Air National Guard, Air Force Reserve, and civilian airmen who understand the nature of the changing security environment. The Service has a much smaller force today that is experiencing a very high operational tempo while absorbing a high technological growth rate. As a result, the Air Force must better utilize the time and effort of its people so it best realizes their expectations while meeting the needs of the Service and the Nation. Force Development is designed to address these challenges. It can be defined as the series of experiences and challenges combined with education and training opportunities that produce Air Force leaders.

Force Development is grounded in doctrine. It starts with a simple Force Development doctrine composed of three levels–tactical, operational, and strategic. At the tactical level, early in their career, airmen should concentrate on learning their primary skill. As they transition into the mid-grade ranks, they should begin to focus

their skills more at the operational level. Airmen may pick up a complementary skill, and the focus should be on understanding the broader air force perspective. As Air Force personnel move into the senior ranks, they should begin to operate at the strategic level, with emphasis on combining their primary and complementary skills and experiences to develop an understanding of not only the Air Force but also how their mission integrates with the DoD, other agencies, allies, and coalition partners. At all three levels, education and training will be carefully tailored to help build the necessary skill sets.

Today, the Air Force has a "career path choice" that encourages the development of a deep perspective in a particular area, i.e., the development of a specialist. It is primarily focused on competency skills in a single Air Force Specialty Code. Careers are frequently stove-piped and development is often left to chance. The new Force Development concept recognizes the continued need for strong grounding in functional areas, but at the same time offers the means to achieve the wider perspective the Air Force needs within its leadership. Skill sets must be driven by requirements and focused on systemic development and enduring competencies. The Air Force has determined that there are clearly identifiable requirements for leaders who have experience in more than one career area. For example, the Air Force may need to grow some fighter pilots who understand space, some acquisition managers who understand plans and programs, and some space/missile operators who understand acquisition, etc. In the Force Development construct, the Air Force will best use the existing amount of time it has for all Developmental Education, training, and experiences, including assignments—all managed through one Development Team.

Developmental Education will be tied directly to Developmental Assignments. The Air Force will provide people with the education necessary both to enhance their primary occupational depth and to transition them into new skill areas where appropriate. Developmental Education will expand to include not only ISS in residence but possibly also highly selective advanced academic degree programs, education with industry, fellowships, and specialty schools. All will be tailored to the individual's Development Plan and better meet Air Force needs.

This transformation in Force Development will touch all aspects of the Air Force force management system. It addresses: accessions, promotions, education and training, evaluations and feedback, information/decision support tools, and the new Development Teams, which will be the lynch pin in the development process. The resulting Force Development system, supported by investments in key technologies, will deliberately develop a force ready to meet the challenges of the 21st century.

Future Total Force (FTF)

The Air Force Reserve Component is critical to enable air operations. For example, during Operation Iraqi Freedom, it flew nearly half of the C-17 and C-5 missions, 90 percent of the C-141 missions, and about 50 percent of the aeromedical evacuations. In addition, the Air Guard flew 43 percent of Air Force fighter sorties and 86 percent of the refueling sorties.

As the Service relies more on Guard and Reserve components to provide critical peacetime and wartime capabilities, it makes sense to allow some units the opportunity to live, work, and train together. FTF would allow each component to contribute its unique strengths to provide the capability, experience, stability, and continuity required to operate today's information- and technology-driven forces. It would also enable the Air Force to make better use of basing infrastructure and maximize the utilization of expensive weapon systems.

One way to implement this is to expand the integration of Active and Reserve component units. Moving Guard and Reserve units with like assets to active bases or vice-versa could facilitate leaner, more efficient operations, maintenance, and infrastructure. The Air Force has already established units using this concept. Examples are the merger of the Air National Guard's 116th Bomb Wing and Air Combat Command's 93rd Air Control Wing to form the 116th Air Control Wing (a Joint Surveillance Target Attack Radar System Blended Wing) at Robins Air Force Base, Georgia; and the integration of Air Force Reserve Command's 8th Space Warning Squadron associated with Air Force Space Command's 2nd Space Warning Squadron at Buckley Air Force Base, Colorado. Reserve Associate and Active Associate units have proven that this concept works and benefits the Active and Reserve Units. Indeed, they have been used for the last 35 years. There are currently a total of 11,000 Air Force reservists assigned to associate units, including 32 Reserve Associate flying units. The movement of the 126th Air Refueling Wing from Chicago to Scott Air Force Base, Illinois represents another example of the efficient use of available infrastructure by different components.

Another possible area for integration is to expand the blending of Guard units across state lines to unify mission areas, reduce infrastructure, and improve readiness while preserving home station control. Active Integrated Reserve Component and Service boundaries could be blended to provide regional entities more useful for homeland defense (e.g., one that includes air defense, Army Guard state responders, and interagency links in a single location).

The Air Force will, per the new *Air Force Strategic Planning Directive for Fiscal Years 2006-2023*, develop options to better leverage all Air Force capabilities and expand Associate Unit programs and "Blended Wing" initiatives.

Human Capital Management Transformation

Underpinning the Service's new Force Development construct, the Air Force Council has embraced a new Personnel Vision and new Personnel Strategic Planning Construct to transform human capital management. This is required to ensure that human capability development meets the ever-changing threat to the United States, addresses one of the new core competencies of the Air Force—Developing Airmen, transforms the manner in which the Air Force delivers human resource support to customers, and enables the realignment of Manpower and Personnel under the same Headquarters Air Force Deputy Chief of Staff.

In the spring of 2003, the Air Force conducted three personnel vision and goal development sessions involving senior leaders of the manpower, personnel, and training community along with Reserve and Guard representatives. These discussions centered on the imperative to transform the Air Force personnel system to be agile and responsive to changing requirements while efficiently serving all airmen. It was clear the personnel community needed to shift thinking from how to meet a given threat to thinking in terms of developing capabilities for warfighters. What emerged from these sessions were a new Personnel Vision and a Personnel Strategic Plan to execute that vision.

The new Vision succinctly states the role of personnel professionals: Right People, Right Place, Right Time—America's Airmen Creating The World's Best Air Force. By accessing, developing, and sustaining the right people and having them at the right place ready to perform at the right time, airmen create the world's greatest air and space power. This vision necessarily drives a new set of goals focused on a transformed view of the traditional personnel lifecycle, which forms the centerpiece of the new Personnel Strategic Plan.

The new Personnel Strategic Plan supports the President's Management Agenda, incorporates feedback from a recent General Accounting Office report, and is directly linked to the new Air Force core competencies. Accordingly, the effects-based strategy focuses on mission outcomes and needed capabilities while optimizing the Air Force's return on investment in its people. This strategy also moves us from a regulatory-based construct to a performance-based construct where the measures of merit are successful mission outcomes. The new strategic goals focus on the effects of the personnel community's mission:

- **Define**—Implement a capabilities-based requirements system that meets surge requirements and optimizes force mix (Active duty, Air Reserve Component, civilian, and contractors) to produce a flexible and responsive force.
- **Renew**—Maintain a diverse, agile workforce that leverages synergy between active duty, air reserve and civilian components, and private industry to meet requirements and sustain capabilities.
- **Develop**—Synchronize training, education, and experience to continuously create innovative, flexible, and capable airmen to successfully employ air and space power.
- **Sustain**—Sustain required force capabilities through focused investment in airmen and their families.
- **Synchronize**—Implement a robust strategic planning construct, understand Air Force Human Resources investment, and link programming and legislative development to the plan.
- **Deliver**—Transform customer service by delivering a leaner, more cost-effective, customer-focused Human Resource Service to support the Air Expeditionary Force.

Innovative Infrastructure Transformation

"A primary objective of BRAC [Base Realignment and Closure] 2005, in addition to realigning our base structure to meet our post-Cold War force structure, is to examine and implement opportunities for greater joint activity. Prior BRAC analyses considered all functions on a service-by-service basis and, therefore, did not result in the joint examination of functions that cross services. While some unique functions may exist, those functions that are common across the services must be analyzed on a joint basis.

"Accordingly, the BRAC 05 analysis will be divided into two categories of functions:

- *"Joint cross-service teams will analyze the common business-oriented support functions and report their results through the [Infrastructure Steering Group to the Infrastructure Executive Council (IEC)].*

- *"The Military Departments will analyze all service unique functions and report their results directly to the IEC."*

–The Honorable Donald Rumsfeld, Secretary of Defense

"The BRAC 2005 process is critical to the Air Force's ability to successfully meet our future mission needs. We must not only reduce the budgetary demands from excess infrastructure, but also ensure that the resulting infrastructure can effectively support projected missions as well as provide maximum flexibility and efficiency for the future."

–Dr. James Roche, Secretary of the Air Force

One way the Air Force will transform its industrial age infrastructure into an information age force is through the Congressionally mandated BRAC. This process uses carefully formulated data collection and analysis to find excesses and deficits in military capacity, which, in turn, helps determine the intrinsic value of a base. Foremost in DoD and Air Force analysis is military value–the ability to successfully meet mission needs while maximizing future flexibility and efficiency.

BRAC 2005 goals are to:

- Maximize warfighting capability efficiently
- Transform the Air Force by realigning infrastructure to meet future defense strategy
- Capitalize on opportunities for joint activity
- Eliminate excess physical capacity to maximize operational capability

In addition to the Future Total Force, discussed previously, potential infrastructure transformation options include:

- **"City-Basing":** Some military bases can divest and privatize selected non-military/non-critical facilities and functions to reduce the DoD's infrastructure. Military installations usually are small cities that lend themselves to local management and operation, perhaps by the private sector, which allows military commanders to concentrate on military operations. However, DoD must not divest functions needed for military wartime or contingency requirements and must ensure troops have access to the same or better services for their money.
- **Joint Basing:** Where sensible, the Services should combine assets on the same bases. By exploring a joint basing concept, the Services can facilitate rapid mobilization by stationing Continental United States (CONUS) units and assets closer to planned ports of embarkation. At the minimum, co-location simplifies the mobility challenge by turning bases into mini-transportation hubs to get troops and equipment down range more efficiently. In addition to the advantages of improved mobility, operational and support units will likewise benefit from joint integration in daily activities and large force, joint, and combined exercises. A prime example is the co-locating of the Services' special operations forces, especially overseas, to reduce infrastructure requirements and enable improved training opportunities. Another possibility would be to co-locate or integrate Service and civilian satellite control assets.
- **Restructure and/or combine Service acquisition organizations:** The Air Force believes combining, merging, and/or co-locating selected acquisition and supply activities can achieve significant efficiency gains. Transforming Service-specific product centers into jointly managed centers for items such as avionics, aeronautics, weapons, fuels, supply, transportation, and a myriad of other common functions would eliminate functional overlap.
- **Partner military depots' workload with industry:** Opportunities exist to partner with industry at government facilities to further reduce infrastructure requirements. In addition, future opportunities may exist to combine certain depot functions across the Services. A future partnership arrangement and joint depot function for the F-35 is a prime example.
- **Restructure/combine Service training activities and organizations:** There are several promising opportunities in this area. For example, the Services could consolidate and/or co-locate commissioning sources or professional military education schools at all levels. The Services could also combine or merge Service specific test pilot schools and collocate test functions. Combining the Services' range management offices into one joint management office would not only reduce overhead but also could produce more efficient use of a precious DoD resource.

In support of the 2005 BRAC and the upcoming QDR, the Air Force, as directed by new *Air Force Strategic Planning Directive for Fiscal Years 2006-2023*, will:

- Identify current force structure capability to support Defense Strategy requirements
- Define Service force structure projections for the mid- and far-term in terms of the Air and Space Expeditionary Force
- Identify alternative force structure concepts and technologies to optimize potential investments
- Develop a long-term (through 2020) Air Force overseas posture plan to address:
  - Regional trends affecting US military access
  - New concepts for regional presence
  - Capabilities required to support forward deterrence and swiftly defeat operations in each of the four critical regions
  - Potential options for future changes to the Air Force's overseas posture

Space Commission Implementation

The changes recommended in January 2001 by the Commission to Assess United States National Security Space Management and Organization, more commonly known as the Space Commission, have the potential for far-reaching transformation of defense and intelligence affairs.

The Space Commission's recommendations revolved around five matters of "key importance that need attention quickly from the top levels of the US Government":

- US national security space interests must be recognized as a top national security priority with Presidential leadership.
- The DoD and intelligence community are not properly organized to meet the national security space needs of the 21st century. A number of disparate space activities should promptly be merged, chains of command adjusted, lines of communication opened, and policies modified to achieve greater responsibility and accountability.
- The Secretary of Defense and Director of Central Intelligence must work closely and effectively together, in partnership, both to set and maintain the course for national security space programs and to resolve the differences that arise between their respective bureaucracies.
- The United States must develop the means both to deter and to defend against hostile acts in and from space.
- The United States must adequately invest in space-related science and technology facilities and people.

The Air Force embraced the Commission's recommendations and worked with the other Services and intelligence community to implement its decisions to transform the way military space is managed and organized. These sweeping changes include career force development, acquisition, operations, budgeting, and planning at the national, DoD, and Air Force levels. The Secretary of the Air Force has been designated as the DoD Executive Agent for Space with broad responsibilities for developing and transforming national security space capabilities. The Space and Missile Systems Center

has also been realigned under Air Force Space Command to enhance space professional development and provide "cradle-to-grave" management of space systems. In addition, the Air Force has developed a Space Career Management Plan to establish and sustain a cadre of space professionals. This plan addresses accession, retention, education and training, career path advancement, and methods for developing a space career field that combines research, development, acquisition, operations, and employment.

Warfighting Headquarters (WF HQ)

The Air Force is presently exploring new organizational concepts to address the command and control and presentation of air and space forces in the 21st Century. While the Air Force has undergone a significant transformation from a "main operating base" mindset to an expeditionary Air Force, its organizational structure has changed very little. The main effort to reverse this course is captured in the Air Force White Paper and Briefing entitled the *Transformational Warfighting Construct*. This proposal would re-engineer the Air Force's command structure to address current and future strategic objectives within anticipated fiscal restraints. The construct envisions the development of full spectrum, joint warfighting structures linked through a collaborative planning network. During the evolution of this construct, the Air Force will be able to proactively integrate with the proposed Standing Joint Force Headquarters while evolving to a fully joint air and space headquarters.

The construct establishes ten warfighting organizations. Seven of these will be regionally focused and three will be globally focused. Each WF HQ will have an A-staff and an Air Operations Center (AOC). The WF HQs will be sized to effectively execute their mission. The headquarters will vary in size, depending on factors such as geographic location, responsibilities, and missions assigned. These WF HQs are intended to be led by a three or four-star general and will be the airman's single voice to the Unified Combatant Commander (UCC). This reorganization is designed to enhance combat capability, integrate combat staffs with AOCs, and provide the UCC an air and space focused-warfighting structure supported by state-of-the-art warfighting command and control. Each WF HQ is focused on its warfighting mission—providing the air, space, information, and computer expertise to execute the National Military Strategy through the combatant commander's plans.

The AOCs included in this construct would not be the same. Some will be "Falconer" mobile AOCs. Some will be mobile but not along the Falconer design. Others like AFTRANS and AFSOF will be functionally built for their specialty. All WF HQs would be integrated into a robust communications network that will facilitate collaborative planning and the rapid transfer of AOC functions between headquarters in the event an AOC is taken down or during the initial movement/stand-up of a mobile AOC. A deployable "monster" AOC will be strategically located in CONUS to respond to loss or disruption to regional AOCs.

VI. Transforming to a Capabilities-Based Force

"In the future, we need to make warfighting effects and the capabilities we need to achieve them the driving factors in our transformational efforts….I want everyone in the business of inventing, developing, building, purchasing, and sustaining to understand this concept: the CONOPS are the foundation of our transformation efforts."

–Dr. James Roche, Secretary of the Air Force

"We are focused always on programs, always on platforms. We are going to change that. So that the first thing we talk about is the concept of operations. How we fight. Not only with ourselves but how we…join with the other Services, with coalition partners."

–General John Jumper, Chief of Staff of the Air Force

While adapting to the new strategic environment, the Air Force's principal focus has been transitioning from a platform-based garrison force to a capabilities-based expeditionary force. Capabilities-based planning is a key tenant of both the 2001 QDR and the National Military Strategy. Capabilities-based planning focuses on developing Air Force capabilities that can and will be employed to achieve desired effects. The Air Force is committed to make effects and the capabilities needed to achieve them the driving force behind its ongoing transformation. In the future, all Air Force operational, programming, and budget decisions will be driven by a predefined capability. To make this essential shift, the Air Force has developed six CONOPS: Global Mobility, Global Response, Global Strike, Homeland Security, Nuclear Response, and Space&C4ISR. The Integration Champion ensures the operational capabilities integrate across the other CONOPS and that solutions from one CONOPS are applied appropriately.

The emerging CONOPS will help enable the shift to a capabilities-based POM by identifying the warfighting capabilities needed to successfully engage and defeat potential enemies. Responsibility for developing these CONOPS falls to the MAJCOMs, with a senior officer on the Air Force Headquarters Air Staff assigned to each CONOPS serving as their "Champion," leading the process.

The Air Force is transforming around these CONOPS. In addition to serving as a roadmap for operators, the CONOPS construct will form the basis for resource allocation, future system acquisitions, and POM submissions in order to find capabilities-based solutions for warfighter problems.

This chapter summarizes each of the CONOPS and the CRRA process.

A. Global Mobility CONOPS

The Global Mobility CONOPS supports the QDR transformation goal of global force projection and sustainment. Quick, effective response to any crisis or contingency mitigates instabilities and reduces adversaries' time to mobilize threats, thereby reducing casualties to US and allied forces. The Global Mobility CONOPS represents a collection of Air Force capabilities designed to meet growing challenges to rapidly deploy US military forces and to initiate operations around the globe in minimal time.

According to the Global Mobility CONOPS, the desired effect of these capabilities is the rapid projection and application of joint US military power. This primary effect is achieved through four effects mission areas.

- **Power Projection through Air Mobility**
  - The seamless integration and effective conduct of air mobility operations with all theater operations.
  - Air Mobility Forces that have the capabilities to seamlessly integrate with joint and coalition forces across all theater boundaries in order to rapidly accomplish the objectives of the combatant commander.
  - The assured ability to deploy, replenish, sustain, and redeploy joint forces in minimum time to allow them to accomplish the missions assigned to them through all phases of conflict.
- **Power Projection through Global Command and Control**
  - Achieve minimum time lapse between the initiation of crisis action planning and the projection and application of joint US military power.
  - Air Force expeditionary planning and force posturing to prepare Air Force forces for rapid, time sequenced deployment, employment, sustainment, and redeployment.
- **Power Projection through Expeditionary Air Bases**
  - Assured ability to mesh seamlessly with other forces (Army, Marine Corps, SOF) to open a base and establish air operations from a spectrum of airfields—austere base, cold base, warm base, and hot base (includes CBRNE environments).
  - Achieve seamless transition from airfield seizure, to base opening, to force employment and sustainment in concert with theater-assigned mobility forces; includes the rapid, efficient redeployment of forces.
- **Power Projection through Space Mobility**
  - The ability to deploy, replenish, sustain, and redeploy space-based forces in minimum time to allow them to accomplish the missions assigned to them through all phases of conflict. The US space capability rests on the foundation of assured access.

As the Global Mobility CONOPS develops, the force required to achieve this effect represents the overall impact of the Air Force capabilities to be presented to the Combatant Commander and, in turn, helps to define the future forces the Air Force will require to perform Global Mobility missions. The capabilities generally fall into the categories of: Air Refueling, Airlift, Global Command and Control, Base Opening/Standup, and Spacelift. The capabilities embodied in the Global Mobility CONOPS leverage the inherent characteristics of air and space power: speed, flexibility, and precision.

B. Global Response CONOPS

The Global Response CONOPS describes the Air Force's ability to globally attack fleeting or emergent, high-value and high-risk targets by surgically applying air and space power in a narrow window of opportunity, preferably in a manner that minimizes collateral damage. At the President's direction, these tailored forces will strike single or multiple targets, with operational surprise, anywhere on the globe within hours and with some degree of persistence. The Global Response CONOPS accomplishes this by developing capabilities to: (1) anticipate world events through global situational understanding, (2) posture forces to respond without warning anywhere on the globe, and (3) neutralize fleeting and emergent targets before they pose a threat to the United States or its Allies. The Global Response CONOPS can operate independently or with other joint forces and will be equipped to strike with kinetic or non-kinetic assets. Its unique characteristics are its speed and responsiveness as it achieves its desired effects on an elusive target set.

Traditionally, US military operations relied on deploying superior power against an adversary in a time-consuming build-up phase before beginning operations. To counter this, potential adversaries are acquiring advanced anti-access systems, including sophisticated air defense and surface attack capabilities, that threaten to discourage US intervention, disrupt coalitions, or prevent forces from operating at forward operating locations. Potential adversaries have become increasingly hesitant to oppose the US military force-on-force and are seeking new ways to counter American strengths. Instead, they are dispersing their critical systems into sensitive areas with high collateral damage potential, in deeply buried bunkers or tunnels, and employing asymmetric offensive capabilities such as terrorist acts, network attack, or subversive media campaigns that undermine coalitions and sway international opinion. Consequently, some US targets have changed from fixed, fielded forces to a series of fleeting and emergent targets. To combat them effectively, the United States must be able to respond swiftly, precisely, decisively, and globally so that it can attack with agile, concealed, and lean air and space power packages that will surprise the enemy at a time and place of our choosing, while causing minimal collateral damage.

The Global Response CONOPS will require unique capability sets that include the ability to clandestinely deploy assets in and out of areas of interest. It will also require the ability to conduct clandestine surveillance and infiltration or extraction operations with other joint force packages. These forces will require common jam-resistant, secure, over-the-horizon communications and the ability to conduct machine-to-machine data exchanges in hostile electronic environments. The Global Response CONOPS requires a truly joint, integrated, and distributed mission rehearsal capability that exploits synthetic battlespace and refines combat operations at all levels from command to execution. Air and space forces require the ability to incorporate sensor-to-shooter, sensor-to-weapon, and sensor-as-shooter architectures, in either independent air operations or air operations in support of, or with the support of, additional joint forces. Supporting ISR must have the capability to rapidly find, fix, target, track, and assess a full spectrum of fixed, mobile, and CBRNE target sets. Moreover, all of these capabilities must mesh to enable highly distributed and decentralized operations, over large and dispersed areas of operations, while maintaining low signature and visibility.

C. Global Strike CONOPS

Potential adversaries have become increasingly reluctant to oppose the US military using force-on-force. Instead, they seek new and asymmetric ways to counter American strength. For example, potential adversaries are acquiring advanced anti-access systems and developing and acquiring weapons of mass destruction to threaten America and discourage intervention, disrupt coalitions, or deny access.

The effects that Global Strike CONOPS capabilities generate are twofold: (1) gain and maintain battlespace access, and (2) High Value Target destruction. In order to achieve these effects, Global Strike capabilities will employ C4ISR, mobility, agile combat support, strike operations, and personnel recovery. Together, these capabilities will rapidly counter adversary anti-access systems and create the conditions required to gain and maintain access for follow-on joint force entry operations. Concurrently, Global Strike assets enabled by these conditions will destroy/neutralize High Value Targets and establish personnel recovery operations.

Pre-conflict, Global Strike assets employing persistent C4ISR, as described in the Space&C4ISR CONOPS, will gain Predictive Battlespace Awareness to locate fixed targets and predict an adversary's probable courses of action, rapidly deploy forces directly from CONUS and forward-based home stations as described in the Global Mobility CONOPS, and utilize Agile Combat Support to sustain deployed operations. At the start of conflict, Global Strike capabilities will "kick down the door" into denied battlespace by rapidly degrading, and then defeating, the adversary's battle-space awareness and anti-access capabilities, clearing the way for joint persistent follow-on operations.

Theater threat levels may initially require large ISR and command and control platforms to remain over-the-horizon or require assets in space. Global Strike capabilities will: (1) fuse joint, coalition, inter-agency, and civil battlespace information; (2) employ manned, unmanned, and space assets in an expeditionary sensor constellation to develop and maintain an accurate view of the battlespace; and (3) conduct over-the-horizon communications and machine-to-machine data exchange in a hostile electronic environment.

In the initial hours of conflict, the Global Strike capabilities will gain access into denied battlespace by rapidly degrading, and then defeating, the adversary's C4ISR, anti-access weapons, and CBRNE weapons and delivery systems. Systems engaged will most likely be low-observable, remote, and standoff supported by focused information operations and guided by flexible, responsive command and control systems.

The Global Strike CONOPS is a transformational concept. Its capabilities will enable joint warfighters to collaboratively improve and develop the proper balance between: (1) stand-off, low-observable, human, and expendable sensors; (2) sensor-to-shooter and shooter-as-sensor methods; (3) centralized and decentralized command and control; (4) bandwidth requirements and availability; (5) manned and unmanned platforms; (6) air, surface, and space platforms; and (7) kinetic and non-kinetic weapons.

D. Homeland Security CONOPS

The objective of this CONOPS is to aid in the transformation of Air Force homeland security planning, programming, requirement, and acquisition processes through Air Force capabilities that support the National Strategy for HLS objectives, DPG, and the QDR.

The Homeland Security CONOPS addresses three primary problem areas: (1) defending the homeland through air and space power in an interagency environment within legal and resource constraints; (2) ensuring proactive coordination with and responsive actions to requests for assistance from local, state, and lead federal agencies without compromising combat mission capabilities; and (3) preserving the ability to project forces overseas in a terrorist threat environment and provide for their protection. This CONOPS encompasses only those missions with points of effort within the territories of the United States and its littoral waters out to 500 nautical miles. Many elements of the HLS mission are employed overseas, including most operational theater missile defense systems. However specific roles, missions, and budget responsibilities are yet to be determined.

Based on its large perimeter, porous borders, and societal emphasis on freedom of travel, the United States remains vulnerable to asymmetric attack. As a result, the Air Force must be prepared to contribute to HLS across the spectrum–whether facing specific weapons (such as CBRNE) or non-kinetic cyber and psychological attacks. More significantly, the domestic character of the HLS mission connotes that force employment, especially ISR, must occur within the guidelines set forth by law. Analysis for the HLS CONOPS begins with Air Force operational capabilities to which legal and policy restrictions are applied. Provisions within Title 10, 32, and 50 of the United States Code define legal roles and actions for domestic employment of both forces and intelligence gathering assets.

The National Strategy for Homeland Security establishes three prioritized objectives: (1) prevent terrorist attacks within the United States, (2) reduce America's vulnerability to terrorism, and (3) minimize the damage and recover from attacks that do occur. The desired effects provided by the capabilities identified in this CONOPS fall into three major areas that parallel the objectives set forth in the National Strategy for HLS: prevent, protect, and respond.

To prevent attacks against the United States, the Air Force must have the ability to deter, detect, predict, and preempt threats to the homeland, particularly those that target friendly resources through the air and space medium. Protection of critical infrastructure, as defined by the DoD and the National Security Council, must ensure continuity of operations, continuity of government, and must preserve key national capabilities, resources, and landmarks during elevated threat conditions. The Air Force must be capable of defeating adversary threats via the Air Sovereignty Alert network, missile defense, unique capabilities to disarm or disable CBRNE weapons, and precision conventional strikes within the US or the littorals. It also requires the appropriate level of protection or procedures necessary to survive and operate through a CBRNE attack or incident.

Homeland security is an exceedingly complex mission. It demands a range of government and private sector capabilities. It calls for coordinated and focused effort from many actors who are not otherwise required to work together. The Air Force will conduct operations consistent with US law as tasked in support of combatant commanders, especially US Northern Command, to preserve DoD's ability to project forces and provide support to civilian authorities.

E. Nuclear Response CONOPS

Now and in the coming decades, the United States is likely to face adversaries possessing a wide range of capabilities, to include CBRNE weapons, which threaten the survival of the United States and its allies. These adversaries include those who support terrorists, have active CBRNE programs, and are developing capabilities to reach forward-deployed US forces as well as US and allied population centers. The ability to deter such adversaries, especially those with authoritarian, unconstrained, and unpredictable leaders, is uncertain. While CBRNE threats are not new, the nature of potential adversaries and the methods they may use have dramatically changed. Therefore, the ways the United States addresses these threats must transform.

The Congressionally mandated Nuclear Posture Review, completed in December 2001, put into motion a major change in DoD's approach to the role of nuclear offensive forces in its deterrent strategy and presents a transformational blueprint for a new strategic posture. The Nuclear Posture Review established a New Triad composed of offensive strike systems, both nuclear and non-nuclear; defenses, both active and passive; and a revitalized defense infrastructure–all bound together by enhanced command and control and intelligence systems. The addition of defenses and non-nuclear conventional capabilities, combined with information operations, will both reduce US dependence on nuclear weapons and improve the ability to deter attack in the face of proliferating CBRNE. The new capabilities, described in the Nuclear Posture Review, reduce the risk to the United States as it draws down its nuclear forces toward a goal of 1,700-2,200 operationally deployed strategic nuclear warheads. The Review also describes the shift from a threat-based planning construct to a capabilities-based planning construct, recognizing the new relationship between the United States and Russia following the collapse of the Soviet Union and the end of the Cold War.

A vital element of the New Triad, the Nuclear Response CONOPS fully supports this new concept by providing safe, reliable, and proficient nuclear forces. Capabilities within the Nuclear Response CONOPS act as the AEF top cover, providing the deterrent umbrella under which joint conventional forces operate. They help to deter nuclear attacks and dissuade any adversary from employing nuclear threats to coerce the United States, its forces, or its allies. They also contribute to deterring other CBRNE attacks, as well as major conventional aggression, that endanger US or allied vital interests. If deterrence fails, the Nuclear Response CONOPS links nuclear strike forces with command, control, information, and adaptive planning capabilities to jointly defeat the enemy, through a variety of nuclear attack options, and to reestablish deterrence upon conflict termination. The critical capabilities of the Nuclear Response CONOPS include joint ISR; joint nuclear command and control; joint nuclear strike forces, strategic and non-strategic; and joint support forces.

F. Space&C4ISR CONOPS

This CONOPS' fundamental objective is to identify and define Space&C4ISR capabilities needed by the Air Force to achieve the right mix of assets for supporting joint and combined operations at all levels of conflict and in all operational environments. The Space&C4ISR CONOPS seeks to guide the development of advanced space, command and control battle management, and C4ISR systems to provide Predictive Battlespace Awareness, facilitate precision attack, and compress the sensor-to-shooter Kill Chain. Ultimately, the Space&C4ISR CONOPS advocates the evolution of strategic, operational, and tactical capabilities that result in globally responsive and persistent forces that become the centerpiece of Joint Command and Control architectures. Space&C4ISR assets deliver decision dominance, the key to gaining supremacy in all environments while ensuring force protection for US soldiers, sailors, marines, airmen, and non-combatants.

ISR provides warfighters with information on the constantly changing battlespace. ISR must be available at all echelons of the joint warfighting force. This capability must employ manned and unmanned, air, space, surface, and subsurface sensors to develop and maintain an accurate picture of the battlespace. Additionally, the cooperation of multiple Services and organizations is required to enhance the provided information. These organizations must share planning and execution information across multiple security levels and work with development organizations so databases are shared and command and control capabilities are interoperable across multiple theater battle management systems. ISR management must include the ability to dynamically operate in a networked environment to compress the Kill Chain and conduct effective predictive operations. Predictive analysis derived from Target Development and Intelligence Preparation of the Battlespace, integrated with ISR planning and operations, come together to form an Air Force concept called Predictive Battlespace Awareness. Intelligence operators will use PBA to provide detailed assessments of an adversary's intentions, capabilities, objectives, and potential courses of action, which will enable commanders to seize and maintain the initiative and create conditions to produce desired effects. The goal is to provide a comprehensive understanding of the battlespace in time, space, and effect, regardless of the adversary, location, opposition, weather, or time of day. Predictive actionable intelligence, based on timely, pertinent, and accurate information, is essential to commanders and decision makers at all levels.

The Capabilities Review and Risk Assessment

In order to precisely assess each CONOPS, the **CRRA** identifies and analyzes current and future capabilities, capabilities' shortfalls, health, risks, and opportunities. The CRRA is a twofold process: each CONOPS executes a CRRA within its effects and capability purview. Then, an Integrated CRRA assesses capabilities and capability shortfalls across all CONOPS. The CONOPS first identify desired warfighting effects and then develop top-level capabilities required to generate those effects. The CRRAs then identify capability gaps, overlaps, and robustness within each top-level capability. Finally, the Integrated CRRA identifies an acceptable level of risk and risk mitigation measures within each capability. This assessment helps the CONOPS Champions articulate any disconnects between required capabilities and programs.

During each CONOPS CRRA, the CONOPS Champion and Risk Assessment Teams will: (1) identify their CONOPS desired effect(s) and top-level capabilities; (2) review existing and planned programs, S&T, and special access programs; (3) determine strengths, weaknesses, and opportunities; and (4) assess capabilities based on analysis of the capability to deal with an adverse event and the impact if the Service fails to provide the capability to achieve the required effects. This analysis will: (1) provide senior Air Force leaders an operational, capabilities- and risk-based focus for investment decision-making across the DOTMLPF spectrum and (2) achieve the goal of using operational warfighting effects as the drivers for resource allocation for the Air Force. This process is transformational as it concentrates on desired battlespace effects vice specific platforms.

Metrics to measure the Air Force's progress towards "transformation" will be derived from this analysis once the CONOPS and CRRA processes have been finalized and specific required capabilities determined.

VII. Developing Transformational Capabilities

"Our legacy aircraft systems were built with specialized roles and they were very good. But we have limited networking, limited all-weather delivery and limited stand off and our sensors are only partially integrated. Our deployments require large logistics tails and we currently employ stealth only at night… The force we are building…will employ multi-mission systems with multi-spectral fused air and space sensors and robust all-weather weapons delivery with increased standoff capability. We will deploy with reduced logistics tails. We will attack with improved range, payload, speed, maneuverability and precision. We will network these systems in ways that enable us to find, fix, track, target, engage and assess in timelines unimaginable just a few years ago. It is our goal to have consistent, persistent intelligence, surveillance and reconnaissance, and, once a decision to attack is made, we will attack instantaneously."

–Dr. James Roche, Secretary of the Air Force

One of the Air Force's three core competencies is "technology-to-warfighter" or translating vision into operational capabilities in order to prevail in conflict and avert technological surprise. This process flows from vision to military strategy and effects, to concepts, to capabilities, to requirements, and then to programs, with the new CONOPS as the primary driver of capability requirements, both transformational and non-transformational. While most of the CONOPS are still in the preliminary stages of development, the Air Force anticipates there are 16 "transformational" capabilities, consistent with the discussion of transformation in Chapter II, based on preliminary analysis. They represent capabilities the Air Force cannot achieve today or must be significantly improved to enable the new CONOPS and DoD's transformation goals:

1. Seamless joint machine-to-machine integration of all manned, unmanned, and space systems
2. Real-time picture of the battlespace
3. Predictive Battlespace Awareness
4. Ensured use of the information domain via effective information assurance and information operations

5. Denial of effective C4ISR to adversaries via effective information operations
6. Penetration of advanced enemy air defenses to clear the path for follow-on joint forces
7. Effective and persistent air, space, and information operations beyond the range of enemy air defenses under adverse weather conditions
8. Protection of vital space assets
9. Denial of an adversary's access to space services
10. Detection of ballistic and cruise missile launches and destruction of those missiles in flight
11. Order of magnitude increase in number of targets hit per sortie
12. Achievement of specific, tailored effects on a target short of total destruction
13. Rapid and precise attack of any target on the globe with persistent effects
14. Rapid establishment of air operations, an air-bridge, and movement of military capability in support of operations anywhere in the world under any conditions
15. Responsive launch and operation of new space vehicles and refueling/repair/relocation of existing vehicles
16. Significantly lighter, leaner, and faster combat support to enable responsive, persistent, and effective combat operations under any conditions

This chapter organizes the transformational capabilities under the six distinctive Air Force capabilities identified and defined in the Air Force Vision:

- **Air and Space Superiority:** the ability to control what moves through air and space to ensure freedom of action
- **Information Superiority:** the ability to control and exploit information to the Nation's advantage to ensure decision dominance
- **Global Attack:** the ability to engage targets anywhere, anytime to hold any adversary at risk
- **Precision Engagement:** the ability to deliver desired effects with minimal risk and collateral damage to deny sanctuary to the adversary
- **Rapid Global Mobility:** the ability to rapidly position forces anywhere in the world to ensure unprecedented responsiveness
- **Agile Combat Support:** the ability to sustain responsive, persistent, and effective combat operations

This chapter also presents a preliminary look at programs, ACTDs, and future system concepts (in *italics*) the Air Force anticipates will help enable these 16 transformational capabilities (see Appendix D for very brief descriptions of them) based on current information and guidance. It distinguishes between those programs and future system concepts expected to come on-line in the near-term (through 2010), the mid-term (between 2010 and 2015), and the long-term (past 2015).

There are several very important caveats concerning these transformational capabilities and associated programs/future system concepts:

- **The nature and details concerning these capabilities and associated programs/future system concepts are subject to change.** Because the new Air Force CONOPS are still under development, it would be preliminary at

this point for the Air Force to provide a final, definitive list of transformational capabilities and necessary programs to enable the capabilities. As the CONOPS and CRRAs are completed, this chapter will be updated in future editions.

- **Achieving many of these transformational capabilities will require more than the combination of key programs and future system concepts listed here.** Many programs associated with these capabilities are too small (and would be too numerous to list here comprehensively) and/or classified and, thus, are not included in this document. Where possible, the chapter groups smaller programs into broad categories. As a result, any comprehensive cost analysis of what the Air Force spends on programs that will enable the sixteen transformational capabilities would need to extend beyond the programs listed here.
- **In addition to the key programs listed here, realizing these sixteen capabilities will also require the development of relevant DOTMLPF and concepts of operations that maximize their transformational potential.** The right people must be organized, trained, and supported the right way to realize the transformational potential of these programs and future system concepts. This will also require additional costs that are not reflected in funding figures for these capabilities.
- **The capabilities described here do not represent a comprehensive look at all the capabilities under development by the Air Force.** They only focus on what the Air Force now considers "transformational" capabilities. There are numerous other critical capabilities under development by the Air Force not included in the Flight Plan. That they are not listed does not make them less important.

A. Information Superiority

Air Force doctrine defines information superiority as the "degree of dominance that allows friendly forces the ability to collect, control, exploit, and defend information without effective opposition." Put simply, this means getting the right information in the right format to the right place at the right time while denying the same to the adversary. Information superiority combines robust, tailored C4ISR, and weather capability with effective information operations. At the operational level of war, IO are comprised of Network Warfare Operations, Influence Operations, and Electronic Warfare Operations. Most operations rely on achieving and maintaining information superiority.

A Key Enabler of Transformation

Information superiority is a key enabler of the type of revolutionary change described by RMA advocates in Chapter II, including effects-based operations and parallel warfare. It would allow US forces to select the precise targets necessary to achieve desired effects and focus on the quality, rather than the quantity, of targets attacked. For example, American forces could identify an adversary's key centers of gravity and relay that information to combat forces in near real-time. Combined with precision-guided weapons, information superiority will enable US forces to attack and destroy the adversary's centers of gravity in a particular sequence that would be the most devastating to the adversary. This capability can defeat an enemy's forces by disabling its ability to function rather than by traditional mass attrition warfare (or achieve "de-massed forces" to use TPG terminology).

Similarly, information superiority, coupled with rapid precision strike and global attack capabilities, would enable the United States to deny sanctuary to its adversaries by being able to strike elusive, mobile targets such as terrorists, targets in urban environments, or CBRNE-related materials as soon as they emerge. Recent operations in Afghanistan and Iraq have demonstrated the immense potential of this capability. In Afghanistan, when targets presented themselves, special operations forces on the ground immediately communicated their locations to B-52s loitering in the vicinity armed with precision-guided weapons. Similarly, Predator Unmanned Aerial Vehicles (UAVs) relayed live video images of enemy targets to AC-130 gunships patrolling in Afghanistan, which then could rapidly engage the targets before they could hide again. During Operation Iraqi Freedom, when a ground source reported that Iraqi leader Saddam Hussein and his sons might be in a particular building, it took less than twelve minutes for an airborne B-1B bomber to strike the building with four Global Positioning Satellite (GPS)-guided munitions. Future global strike capabilities will greatly expand this "quick strike" capability beyond the theater-level to the strategic-level.

Even if these effects were not possible, information superiority would also enable the US military to achieve "decision cycle dominance" through speed of command, shared awareness, self-synchronization, and eliminating process and structural lines. This would allow friendly forces to act and react much more rapidly and effectively than any adversary who lacks these capabilities, creating significant military advantages. Information superiority can provide the commander information on adversary intentions and courses of action before and during crises, identify and develop target solutions that enable him to achieve his objective, position ISR assets to provide him a clear battlespace picture, and provide him a means to assess the results of his actions. This capability is enhanced through the integration of sensors, command and control, and Tasking, Processing, Exploitation, and Dissemination (TPED) systems to provide the commander with situational awareness in all conditions to enable increased speed of command as well as Blue Force Tracking to minimize fratricide. While technology will never completely overcome the "fog of war," achieving information superiority could certainly minimize that fog for US forces and maximize it for the enemy.

Information superiority enables additional transformational benefits:

- Because it would enable the United States to conduct operations with smaller forces in many situations, it would greatly enhance America's ability to rapidly deploy forces abroad, which is key in the post-Cold War security environment.
- By avoiding the need for massive attrition tactics, information superiority would also result in far fewer casualties and collateral damage under most circumstances.
- Under the right circumstances, effective IO capabilities, to include network attack, electronic warfare, PSYOP, military deception, and public affairs operations, could prevent hostilities by influencing adversaries to capitulate before the shooting starts, thus greatly enhancing America's "deter forward" capability.
- Information superiority will significantly enhance virtually all types of operations ranging from high intensity combat to counterterrorism, urban operations, homeland security, peace operations, and special operations.

- Information superiority can provide commanders with the flexibility to adjust ISR support between theaters as the worldwide situation dictates, while allowing national-level leadership adequate time to develop plans on how to employ all elements of national power.

Information superiority capabilities will also provide the foundation of the Space&C4ISR CONOPS, whose goal is to achieve horizontal machine-to-machine integration of manned, unmanned, air, surface, information, and space systems to provide executable decision-quality knowledge to commanders in near real-time. Information superiority is also essential to achieve the other new Air Force CONOPS. For example, the Global Strike CONOPS has the requirement to employ persistent, all-weather C4ISR prior to and during conflict. In the initial hours of a conflict, the Global Strike CONOPS would also use IO, among other tools, to gain access to denied areas and proactively establish an information battlespace friendly to further operations. Similarly, the Global Response CONOPS intends to use IO as a tool to rapidly strike terrorist targets anywhere in the world. The Homeland Security CONOPS has the requirement for the defense of critical infrastructure including information systems, which will require IO capabilities.

Progress Towards Information Superiority

During the 1990s, the Air Force made significant progress in improving its information superiority capabilities. It has greatly increased the number of quality sensors, multi-sensor platforms, and the capability to process, analyze, and distribute data quickly over vast distances. This has led to an order of magnitude increase in situational awareness and the capability to conduct operations more flexibly and rapidly. The Air Force has made substantial gains in communicating information through the Global Information Grid and should have a small-scale horizontal integration capability as soon as 2006.

ISR sensors have been mounted on air breathing platforms such as the E-3B/C Airborne Warning and Control System, RC-135, and U-2. The United States also developed the E-8C JSTARS, which can detect moving targets over an area 10,000 times greater than the same radar attempting to provide a high-resolution image. The computational power onboard the JSTARS also increased 200 times from the Gulf War to Serbia and continues to rise today. In addition, in 1991, sensor data transmitted over line-of-sight links encountered routine delays. By 1999, U-2 imagery was transmitted instantly to the United States via satellite links, analyzed, and promptly relayed electronically to the Combined Air Operations Center in Italy.[2]

Recent operations recently demonstrated the incredible effects that information superiority can have on the battlefield. Weapons conceived in the 1970s and 1980s, and fielded in the 1990s, now are having a revolutionary effect on combat. A variety of joint systems and precise weapons, aircraft like the JSTARS, remotely piloted aircraft, UAVs, a generation of space assets, and the ability to integrate them all proved decisive in Operation Iraqi Freedom.

[2] Robert Haffa, Christopher Bowie, and Robert Mullins, "Future War: What Trends in America's Post-Cold War Military Conflicts Tell Us About Early 21st Century Warfare," Northrop Grumman (January 2003), 50-51.

In addition, this improved integration of sensors, networks, and the TPED process has enabled very flexible and adaptive operations. During Operation Desert Storm, only 20 percent of sorties received their targets or had their targets changed after launch. This increased to 43 percent during Operation Allied Force and 80 percent during Operation Enduring Freedom. Initial data shows that more than 90 percent of sorties during Operation Iraqi Freedom received updated target information enroute. This gave the joint commander immense flexibility to adjust to the rapidly changing operational and tactical situation and enhance effects-based operations.

Remaining Obstacles

Despite these gains, however, there are still many obstacles to achieving the full potential of information superiority under many circumstances today:

- There is still significant progress to be made in rapidly getting timely, accurate, and relevant intelligence from sensors-to-shooters (actionable intelligence in a usable format) in single-digit minutes.
- Battlespace awareness information is often reactive in nature and rapidly loses relevance. Targeting decisions often are made too far away from the warfighter to effectively engage mobile targets.
- It is still very difficult to integrate rapidly expanding data streams from multiple sources in a timely manner.
- Commanders often do not have a clear, accurate real-time picture of the battlespace.
- The military still cannot assess, plan, and direct air and space operations from anywhere or from multiple locations in near real-time, something the Air Force believes will be necessary in the future to give the commander the greatest flexibility to meet national tasking.
- Computer network and information systems are often vulnerable to attack.
- There is limited ability to disrupt adversary C4ISR assets and information flow.
- "Tribal" platforms and procedures within the Air Force still must be integrated using information technology.
- New and planned C4ISR systems require a lot of additional bandwidth.
- Lack of data standards inhibits use and exploitation of Artificial Intelligence capabilities.
- The Air Force lacks a scalable C4ISR system that can support operations across the spectrum of conflict.
- The Air Force has not developed all necessary protocols for machine-to-machine interfaces.
- The Air Force still needs to evaluate its current systems and determine what they can contribute to its capabilities and what tools are necessary to transform those systems from a collection of platforms into a networked system that is greater than the sum of its individual parts.

Related Transformational Capabilities

The following related transformational capabilities, when achieved simultaneously, will address these shortfalls and enable information superiority under most circumstances:

1. **Seamless joint machine-to-machine integration of all manned, unmanned, and space systems**
2. **Real-time picture of the battlespace**
3. **Predictive Battlespace Awareness**
4. **Ensured use of the information domain via effective information assurance and information operations**
5. **Denial of effective C4ISR to adversaries via information operations**

The **seamless joint machine-to-machine integration of all manned, unmanned, and space systems,** not just Air Force systems, will ensure that the right information gets the right place at the right time and numerous DoD and national assets are interfaced. This includes integrating multi-spectral information across the intelligence disciplines. The Air Force, as directed by the *Air Force Strategic Planning Directive for Fiscal Years 2006-2023*, will develop a master plan to achieve this machine-to-machine integration.

While machine-to-machine interfacing is one step to reducing decision cycles, decomposing data into readily accessible items by any information technology capability is vital as it lays the foundation for future developments, encourages advancements in artificial intelligence capabilities, and eliminates the need to re-engineer data as these capabilities evolve. Industry and government research into neural networks and artificial intelligence would be significantly enhanced if there were structured data to process against. Using technology to make even first-degree correlations would greatly reduce manual research processes.

Real-time picture of the battlespace includes the following two transformational capabilities from the recently completed *Strategic Master Plan: FY04 and Beyond* by Air Force Space Command: (1) an initial space-based Ground Moving Target Indicator capability in the mid-term to provide US global strike forces with the ability to identify and track moving targets anywhere on the surface of the earth and (2) a far-term capability to detect, locate, identify, and track a wide range of strategic and tactical targets that the United States currently has minimal capability to detect. These include weapons of mass destruction, hidden targets, and air moving targets. Real-time picture of the battlespace also includes Blue Force Tracking capabilities that enable the Joint Force Commander to know where all friendly forces are to both better coordinate operations and avoid fratricide.

Predictive Battlespace Awareness, discussed in the last chapter, is a commander-driven process to predict and preempt adversary actions when and where we choose. PBA is an integrated process involving Intelligence Preparation of the Battlespace, Target Development, ISR Strategy and Planning, ISR Employment, and Assessment that provides the commander a multidimensional understanding of the battlespace in time, space, and effect, regardless of the adversary, location, weather, or time of day.

PBA is continuous and achieved by the commander through possession of relevant, comprehensive, knowledge, including an accurate forecast of pertinent influences in the battlespace. This knowledge of the operational environment, in concert with command and control, permits commanders to anticipate future conditions, assess changing situations, establish priorities, exploit emerging opportunities, and act with a degree of speed and certainty not matched by adversaries. PBA-derived insights allow the United States to use critical ISR assets for confirmation rather than pure discovery once hostilities begin. Additionally, the PBA process enables Space Situation Awareness to function as the foundation of offensive- and defensive-counterspace operations, by preparing to conduct operations in, from, through, and to space, utilizing cyber-, space-, air-, land-, and sea-based capabilities. PBA will be a key enabler of DoD's goal to "deter forward."

These three transformational capabilities can provide a revolutionary advantage for US forces only if the joint commander can ensure that the adversary: (1) cannot disrupt, manipulate, or destroy the associated friendly information, information systems, and information processes on which they rely; and (2) cannot achieve the same capabilities or enjoy the advantages of advanced C4ISR.

Achieving the first requires **effective information operations that ensure friendly use of the information domain**. As the world's most information-dependent fighting force, the US military must use the IO capabilities of network defense, information assurance, operations security, counter-deception, counterintelligence, and counter-propaganda to reduce the ability of adversaries to exploit its reliance on information and assure jam-resistant, secure, survivable C4ISR. By integrating these defensive capabilities to protect or project the commander's objectives and themes, military operations have a much greater chance at success.

Against adversaries with effective C4ISR, achieving the second requires **effective information operations capabilities that can deny, manipulate, or significantly degrade adversary C4ISR.** These capabilities include network attack, electronic warfare, military deception, public affairs operations, operations security, and psychological operations.

In addition to the information superiority efforts described in the box below, the Air Force is also installing capabilities in virtually all of its new (such as the F/A-22, F-35, and unmanned vehicles) and existing (perhaps the most well known examples during recent operations is the B-52 and the AC-130) weapon systems and platforms that will enable them to fully integrate with the joint C4ISR network envisioned by OSD and participate in time-critical targeting.

Please refer to Appendix B for details on Air Force information superiority efforts required by the TPG, especially in the areas of interoperability, information operations, and intelligence.

Key Programs/*Future System Concepts* Enabling Transformational Capabilities 1-5:

Near-Term (until 2010): Advanced Extremely High Frequency system, Advanced Tactical Targeting Technology ACTD, Airborne Networking capability, Air and Space Operations Center, Air Force Network Operations and Security Center, Air Force Satellite Control Network upgrades, Air Force Transformation Center (formerly CAOC-X), Automated ISR, Combatant Commanders Integrated Command and Control System, Combat Information Transport System (ongoing into long-term), Distributed Common Ground System, eXtensible Markup Language, Family of Interoperable Operational Pictures (Common Relevant Operational Picture), Family of Small Unmanned Systems, Global Broadcast System, Global Hawk, Global Positioning System Block IIF/III, Ground Warrior Modernization, ISR Management capability, Integrated Broadcast Service, Joint Mission Planning System, Joint Tactical Radio System, Link 16, Multi-Platform Common Data Link, Multi-Platform Radar Technology Insertion Program, Single Integrated Air Picture, Situational Awareness Data Link Gateway, "Smart Platforms" (including Roll-on Beyond Line of Sight Enhancement and family of Scalable, Modular, Airborne, Relay Terminals), Tactical Data Link Architecture enhancements, Transformational Communication Terminals, Transformational Satellite, numerous information operations programs

Mid-Term (2010-15): Adaptive Battlespace Awareness ACTD, Adaptive Joint C4ISR Node ACTD, Command and Control Constellation, Deployable Theater Information Grid, Digital Imagery Request and Distribution System, F-35, Multi-sensor Command and Control Aircraft, Network Centric Collaborative Targeting ACTD, Space-Based Radar, Tactical Unmanned Aerial Vehicle Initiative, Time-Critical Targeting Functionality ACTD, additional IO programs

Long-Term (past 2015): *Biofeedback System, Biomarker System, Enhanced Human Performance,* High Powered Microwave Airborne Electronic Attack, *Military Intelligence Tactical Element—Urban Surveyor, Theater Air Control System*, additional IO programs

B. Air and Space Superiority

Six transformational capabilities the Air Force is pursuing support the Air and Space Superiority distinctive capability from *Air Force Vision 2020*. They fall into three major subcategories: Negating Enemy Air Defenses, Space Superiority, and Missile Destruction in Flight.

Negating Advanced Enemy Air Defenses

The proliferation of advanced, radar-guided SAMs and air-to-air missile systems among potential adversaries puts the ability of legacy aircraft to operate in enemy airspace in the future in question. This new generation of "double digit" SAMs are far more capable than existing systems in acquiring and engaging multiple legacy aircraft. They also use shorter times to emit radar energy and are mobile, making them much more difficult to detect. They are also resistant to jamming, use high mach missiles, and are more mobile. But perhaps most dangerous of all is their significantly increased range, which would require legacy aircraft to fly within range of the SAMs to deliver their weapons. Maintaining the ability to perform unrestricted operations within heavily defended airspace into the future is an essential precondition to successful US joint power projection operations.

In addition to IO capabilities that can affect enemy air defenses, the Air Force is developing two complimentary transformational capabilities to achieve this goal:

6. **Penetration of advanced enemy air defenses to clear the path for follow-on joint forces**
7. **Effective and persistent air, space, and information operations beyond the range of enemy air defenses under adverse weather conditions**

While it might be tempting to invest solely in standoff weapons instead of stealthy penetrating platforms to defeat advanced integrated air defense system, a mix of both is required for several reasons. First, standoff weapons are extremely expensive compared to direct attack weapons. Second, standoff weapons take far more time to strike targets than penetrating platforms, allowing adversaries adequate time to conceal or move targets out of harm's way or intercept the US weapon in flight. There are also various situations in which time-critical strikes are required, which long-range standoff weapons cannot provide. Third, standoff weapons are not as versatile as penetrating platforms at striking all types of targets, especially mobile ones.

Penetrating Advanced New Air Defense Systems

This capability is required to gain entry into denied battlespace and clear the way for joint follow-on forces by rapidly degrading, and then defeating, the adversary's C4ISR, anti-access weapons, and CBRNE delivery systems. Hopefully, such a capability will also dissuade adversaries from investing in such new air defenses to begin with. The key to penetrating the next generations of advanced enemy air defense systems is producing systems that are survivable against them at all times and in all weather. This is achieved by using advanced space force applications systems and capabilities as well as by combining improved "stealth" with state of the art speed, avionics, radar, and maneuverability. Currently, the Air Force's stealthy fleet is limited to a small force of B-2 bombers and F-117s, which may be inadequate to defeat future generations of air defense systems coming online. In addition, they can only exploit their stealthy qualities at night, as they cannot effectively defend themselves during the daylight if spotted visually.

Negating Advanced Enemy Air Defenses also includes the ability to conduct deep, clandestine special operations missions in support of the Joint Force Commander's operational preparation of the battlespace. The Air Force's capability to conduct long-range, clandestine, or covert infiltration and exfiltration of special operations forces and equipment is rapidly degrading with advances in air defense systems and long-range aircraft detection technology. The 2001 QDR states special operations forces need to have the "ability to conduct covert deep insertions over great distances." These two points, when combined with the joint doctrine of early introduction of special forces deep in denied, hostile, or politically sensitive areas to help prepare the battlespace, drive the required capability for airpower to penetrate advanced enemy air defenses and enable special forces to achieve critical tactical surprise deep in denied airspace. The required capability can be approached from the "platform" or what performs the clandestine penetration of denied, hostile, or politically sensitive airspace, or it can be viewed as a means to deliver joint special operations capabilities that can strike strategic targets, before or during conflict—to include terrorists.

Standoff

The United States has had significant standoff precision strike assets for some time. It began with cruise missiles, which were first used to strike land targets during the Gulf War. However, while effective at precisely striking targets at long range, they are too expensive to use more than in limited numbers. Reducing the cost of the weapons while maintaining long-range has proven very difficult. Current cruise missiles also have limited ability in bad weather and against mobile targets. Developing an affordable standoff weapon that would enable large scale, persistent standoff operations against fixed and mobile targets in all weather would create a huge transformational effect in defeating future advanced air defenses. Standoff will also be a key enabler of the Joint Commander's ability to use the Global Strike CONOPS' capabilities to operate successfully in heavily defended airspace at the start of a conflict and the Global Response CONOPS' capabilities to conduct rapid response operations against terrorist-related targets.

Key Programs/*Future System Concepts* Enabling Transformational Capabilities 6-7:

Near-Term (until 2010): F/A-22, Joint Air To Surface Standoff Missile—Extended Range, Unmanned Combat Aerial Vehicles

Mid-Term (2010-2015): Common Aero Vehicle, F-35

Long-Term (past 2015): *Advanced Standoff Cruise Missile, Air Expeditionary Force Weapon, Extended Range Strike Aircraft, Hypersonic Standoff Weapon, Hypervelocity Missile, Long Range Cruise Missile, M-X Low Observable Advanced SOF Air Mobility Platform, Robust Autonomous Attack Missile, advanced Unmanned Combat Aerial Vehicles*

Space Superiority

Space capabilities are integral to modern warfighting forces, providing critical surveillance and reconnaissance information, especially over areas of high risk or denied access for airborne platforms. They also provide weather and other earth-observation data, global communications, precision position, navigation, and timing to troops on the ground, ships at sea, aircraft in flight, and weapons enroute to targets. Space assets are critical to achieving information superiority as they enable predictive and dominant battlespace awareness, C4ISR integration, and reducing the "sensor-to-shooter" cycle to minutes or even seconds. Space assets are also critical in reducing the forward footprint and enabling standoff attacks. Space superiority is also very important in enabling the integration of C4ISR and PBA required by the Space&C4ISR CONOPS and Global Strike CONOPS. The part of space superiority focused on protecting space assets is also critical for one mission of the Homeland Security CONOPS—the protection of critical infrastructure, which includes ground-based space assets. The remaining CONOPS will also rely heavily on space-based C4ISR assets. The United States cannot effectively exploit space for joint warfighting in these ways if it does not have responsive, reliable, and assured access to space, which requires achieving and maintaining space superiority. It is important to emphasize that space superiority does not include the actual use of space for C4ISR and other purposes. Instead, like air superiority, space superiority consists of activities that enable us to use space for those activities without interference from adversaries and prevent adversaries from using space for the same purposes.

The advantages these space assets provide are at risk because adversaries are acquiring equivalent systems and abilities to exploit space that would either deny America's use of space or enable similar capabilities. Commercial space capabilities, especially hi-resolution imagery, are now easily available to most nations. Foreign governments

constitute 40-80 percent of the commercial remote sensing market. In addition, the cost of launching and maintaining effective satellites is no longer cost prohibitive for a growing number of countries, especially with the advent of microsatellites.

Another area undergoing rapid change is the attention potential adversaries are applying to denying America's space advantage. They are greatly expanding their capabilities to exploit the vulnerabilities of American space assets. The designs for GPS and satellite communications jammers fill several Internet sites. GPS jammers are also readily available for purchase over the Internet.

Having a complete grasp of what is affecting the battlespace with respect to the space arena is critical to allowing the United States to exploit space and protect its assets from exploitation. Space Situation Awareness combines command, control, intelligence, surveillance, reconnaissance, and the environment to understand space operations, threats to operations, and impacts. Space Situation Awareness enables the Air Force to conduct offensive and defensive operations to gain and maintain space superiority. The Space AOC, in conjunction with theater AOCs, is the focal point that will have the situational awareness necessary to perform tasking deconfliction and Predictive Battlespace Awareness for space systems and to build target folders, among other duties.

Achieving and maintaining space superiority in the future requires the following transformational capabilities:

8. **Protection of vital space assets**
9. **Denial of an adversary's access to space services**

These capabilities incorporate the transformational capabilities described in Space Command's recent Strategic Master Plan associated with Mission Support and Counterspace.

The ability to protect vital space systems is essential to ensure that an adversary cannot disrupt, deny, or destroy America's ability to exploit space-based C4ISR assets as previously described. This capability encompasses: (1) space-based space surveillance systems that provide details of space objects unattainable by ground-based systems; (2) an attack detection and reporting architecture capable of detecting, characterizing (identify and geo-locate), and reporting attacks on space systems and of assessing the resulting mission impacts; (3) active on-board capabilities to protect friendly space systems from man-made or environmental threats; and (4) adequately protecting key ground systems, to include backup command and control capabilities. This transformation will be enabled by both material solutions as well as doctrinal and organizational changes.

The ability to deny an adversary's access to space services is essential so that future adversaries will be unable to exploit space in the same way the United States and its allies can. It will require full spectrum, sea, air, land, and space-based offensive counterspace systems capable of preventing unauthorized use of friendly space services and negating adversarial space capabilities from low earth up to geosynchronous orbits. The focus, when practical, will be on denying adversary access to space on a temporary and reversible basis.

In addition, both protecting space systems and denying access to space requires the rapid launch and repair of space vehicles, a transformational capability discussed in more detail under the "Rapid Global Mobility" section.

Key Programs/*Future System Concepts* Enabling Transformational Capabilities 8-9:

Near-Term (until 2010): Counter Satellite Communications System, Counter Surveillance and Reconnaissance System, Rapid Attack Identification Detection and Reporting System, Single Integrated Space Picture, Space-Based Space Surveillance System, Space Control Range

Mid-Term (2010-15): Common Aero Vehicle, Compact Environmental Anomaly Sensor II ACTD, Communication/Navigation Outage Forecasting System ACTD, Orbital Deep Space Imager, Space Tracking and Surveillance System

Long-Term (past 2015): *Air Launched Anti-Satellite Missile, Ground Based Laser, Orbital Transfer Vehicle, Space-Based Radio Frequency Energy Weapon, Space Maneuver Vehicle, Space Operations Vehicle*

Missile Destruction in Flight

One key component of Homeland Defense, a key transformation objective of the 2001 QDR, as well as the Homeland Security CONOPS, is the ability to protect the territorial United States from ballistic missile attack. It is also essential to protect deployed forces from such attack. Therefore, the Air Force is pursuing the following transformational capability:

10. Detection of ballistic and cruise missile launches and destruction of those missiles in flight

Key Programs/*Future System Concepts* Enabling Transformational Capability 10:

Near-Term (until 2010): Airborne Laser, F/A-22, Multi-Platform Radar Technology Insertion Program, Space-Based Infrared System—High, Space Tracking and Surveillance System

Long-Term (past 2015): *Evolutionary Aerospace Global Laser Engagement*

C. Precision Engagement

Technology has enabled munitions to strike with incredible accuracy. Before precision-guided munitions (PGMs), the only option to strike a target with air power was to send numerous sorties to drop a large amount of ordinance. The number of sorties required put many aircrews at risk, required extensive forward basing, and often resulted in extensive collateral damage around the target. Precision strike capabilities today require few weapons per aimpoint (often as few as one), and the accuracy of the munitions means less exposure for aircrews and significantly reduced potential of collateral damage.

	1943	1970	1991
Bombs	9000	176	1
Sorties	1500	88	1
Circular Error Probability[3]	3300 feet	400 feet	10 feet

TABLE 3: Quantity of 2000 Pound Bombs Assigned for 90% Probability of Kill of One Target
Source: DIA

As shown by the table above, the transformational effects of PGMs are obvious as they have greatly reduced the number of sorties required to strike a target successfully. This means that, in many instances, the United States doesn't need to deploy as many forces (air, sea, and ground) to achieve the same capability and, thus, can deploy more rapidly, which is a key goal of DoD's transformation overall. Conversely, it means that the same number of forces armed with PGMs can strike many more targets successfully than a force without PGMs, enabling orders of magnitude improvement in overall firepower. PGMs also greatly reduce collateral damage, which is especially critical in today's operations–especially those that are less than "total war," such as those that prevail in the post-Cold War security environment. Precision strike is also a key enabler of efficient effects-based operations and parallel warfare, which, in turn, is critical to the ongoing "revolution in military affairs" discussed in Chapter II. The number of PGMs as a percentage of air-delivered weapons has steadily increased from 7.7 percent during

[3] Circular Error Probability is the circle in which there is a 50% probability the bomb will land on the target.

Operation Desert Storm, to 40.5 percent during Operation Allied Force, to 60.4 percent during Operation Enduring Freedom, to 68 percent during Operation Iraqi Freedom. The results have been devastating. During Operation Iraqi Freedom, US precision air strikes reportedly destroyed 1,000 Iraqi tanks and reduced the combat strength of several Republican Guard divisions by fifty percent or more in less than one week– a feat that took six weeks of air strikes in the initial Gulf War.

The next steps of this ongoing transformation involve the following two transformational capabilities:

11. Order of magnitude increase in number of targets hit per sortie
12. Achievement of specific, tailored effects on a target, short of total destruction

The increased accuracy of today's precision weapons reduces the need for explosive power to destroy a target. In most cases, this means that smaller munitions can be deployed to strike targets. Smaller munitions means that more can be deployed per sortie. Instead of measuring how many sorties it takes to destroy one target, the standard is now how many targets can be destroyed per sortie. This magnitude of increase in strike capability would enable the United States to conduct an even higher volume of attacks against hundreds of critical targets in the early hours of conflict with a small number of platforms (thus requiring a smaller footprint) with a lower amount of collateral damage. The Air Force is beginning to explore the next obvious step: to develop miniature munitions that can loiter on their own to detect and destroy time-critical targets as they emerge.

Achieving effects without destruction will significantly enhance America's ability to minimize collateral damage. At present, the usual option to affect a target is to destroy it with a kinetic weapon. By creating effects short of total destruction, the United States could conduct more precise EBO that match capabilities to desired effects. Such a capability is critical in the post-Cold War operations that are short of traditional conventional warfare, such as urban and peace operations, which often require capabilities that can deliver timely desired effects while minimizing collateral damage to infrastructure and people. Tailoring effects is also critical to disable weapons of mass destruction without catastrophic collateral damage.

Various non-lethal weapons, directed energy weapons (which include lasers and high powered microwave), and other IO capabilities, discussed in more detail under Section A of this chapter regarding information superiority, are the key to this capability. Together, they also enjoy the following transformational characteristics compared to traditional systems:

- Long-range force application capabilities
- Near-instantaneous and new classes of target effects
- Potentially unlimited magazines in some cases
- Enablers of new missions
- Significantly smaller logistics footprints than non-directed energy weapon systems
- Reduced operational costs and lower manpower requirements

The Air Force recently completed a "Directed Energy Master Plan," which articulates its strategy to develop and transition directed energy applications such as precision engagement as well as information superiority, space superiority, and ballistic missile defense. It also identifies six directed energy science and technology programs that offer near-term transformational capabilities to the Air Force if funding was accelerated: Advanced Tactical Laser, High Powered Microwave Airborne Electronic Attack (see Information Superiority section), Airborne Active Denial System, the Evolutionary Air and Space Global Laser Engagement, and the 100 Kilowatt Solid State Laser.

Key Programs/*Future System Concepts* Enabling Transformational Capabilities 11-12:

Near-Term (until 2010): Small Diameter Bomb; various IO capabilities and agent defeat weapons

Mid-Term (2010-15): Active Denial System ACTD, Advanced Tactical Laser ACTD

Long-Term (past 2015): Airborne Active Denial System, *Cooperative Persistent Surveillance Strike Vehicle,* Evolutionary Air and Space Global Laser Engagement (EAGLE) Airship Relay Mirrors, *Guardian Urban Combat Weapon, Low Cost Persistent Area Dominance Miniature Missile, Next Generation Gunship,* Solid State Laser (100 Kilowatt), *Wide Area Search Autonomous Attack Miniature Munition*

D. Global Attack

Currently, striking conventional targets across the globe from the United States requires employing long-range bombers, which takes many hours and enables mobile targets to hide before the strike force arrives. The key to achieving DoD's current transformational objective of denying sanctuary to adversaries is:

13. Rapid and precise attack of any target on the globe with persistent effects

A non-nuclear, prompt, global attack capability will provide the United States with a range of options for deterrence and flexible response when rapid response is absolutely critical, risks associated with other options are too high, or when no other courses of action are available. Such rapid global attack would likely be used against extremely high value targets such as hardened command and control facilities, terrorists, fixed and mobile integrated air defense system elements, theater ballistic missile launchers, and CBRNE production, storage, and delivery.

This capability would be a key enabler of the Global Response CONOPS' mission of holding terrorist-related targets at risk everywhere. It would also allow the United States to project power almost immediately in areas with no forward-deployed forces or easy access. Indeed, the traditional US method of deploying air and ground forces at or through ports and airfields will grow more problematic as national and commercial satellite services, missiles, and CBRNE technology rapidly evolve. This capability would also buy valuable time should additional forces need to be deployed to the theater.

Key Programs/*Future System Concepts* Enabling Transformational Capability 13:

Near- to Mid-term (up until 2015): Common Aero Vehicle, Various IO capabilities

Long-Term (past 2015): *B-X Bomber, Hypersonic Cruise Vehicle, Hypervelocity Rod Bundles, New Long-Range Platform*

E. Rapid Global Mobility

Rapid global mobility is the ability to establish air base operations and quickly position forces and equipment where they are needed. Airlift, spacelift, air refueling, and dynamic global command and control are crucial components in America's capability to operate around the globe. It allows the United States to reach out and influence events around the world, not only during combat but also during peacekeeping and humanitarian operations. The immediacy of terrorist and other asymmetric threats to US interests at home and abroad, as well as the fleeting, often ephemeral nature of emerging targets, demand the timely deployment of US military forces anywhere in the world and rapid projection of CONUS-based combat power. The Nation must be able to rapidly respond globally to support the full spectrum of operations. Quick and effective military response can mitigate instabilities harmful to the security interests of the US and its allies.

As the Army pointed out in its June 2002 transformation roadmap, American forces must become increasingly more responsive, deployable, agile, versatile, lethal, survivable, and sustainable. Some relevant transformational Air Force efforts in these areas are discussed in other sections, especially in the following Agile Combat Support section. It also requires the following transformational capabilities:

14. Rapid establishment of air operations, an air-bridge, and movement of military capability in support of operations anywhere in the world under any conditions

15. Responsive launch and operation of new space vehicles and refueling/repair/relocation of existing vehicles.

Achieving the first will require that the United States be able to provide airlift, aerial refueling, en route infrastructure, global command and control, and bare base opening to respond within hours of tasking to support peacetime operations or a crisis (up to a major theater war) while maintaining the ability to rapidly swing high priority forces to another major theater war. Such a capability is critical to the Global Strike CONOPS' requirement of being able to employ directly from continental United States and forward-bases with little or no warning as well as the Global Mobility CONOPS' requirement to provide austere air base operations and rapid and effective air mobility support to combatant commanders supporting the full spectrum of operations, from global strike to humanitarian relief and noncombatant evacuation operations. In addition, several rapid deployment tasks will contribute to the Global Response CONOPS' mission of holding terrorist-related targets at risk with SOF. Achieving this capability would also significantly enhance the US military's ability to conduct operational maneuvers from strategic distances.

The "way ahead" to improve rapid global mobility is contained in the Mobility Air Forces' strategic plan, Air Mobility Master Plan 2004 (AMMP 04). This plan compiles and identifies the future requirements of over 20 organizations and components making up the Mobility Air Force Partnership. All partners play a crucial role in defining future mobility requirements. The AMMP 04 is a capabilities-based plan looking out 25 years to ensure air mobility remains capable of rapidly establishing air operations, establishing air bridges, and providing movement of forces anywhere on the globe under increased threat and adverse weather conditions that have historically restricted Mobility Air Force access. Modernization efforts are intertwined with the transformation process to provide an increase in overall mobility capability.

The plan first calls for increasing lift capabilities and improving the Air Forces refueling capabilities. It also calls for various technological improvements. Enhanced defensive systems will allow operations in hostile threat environments. Autonomous approach and landing equipment will enable operations to be conducted regardless of weather conditions and independent of ground-based navigation aids. Automated air refueling technologies will permit the refueling of manned as well as unmanned air vehicles on fueling tracks obscured by clouds. Mobility, strike, and ISR operations would not be degraded by weather in the refueling areas. Interoperable Mobility/Combat Air Force command and control systems will enhance global mobility operations. In the future, a family of transport category aircraft will significantly improve mobility support to the warfighter. They will be capable of transporting the Future Combat System, regardless of weather conditions, over intercontinental ranges to unimproved landing areas in a threat environment. Variants, with common engines, airframes, and cockpits, could be built to fly a variety of airlift, special operations, ISR, and refueling missions. With this approach, aircraft development and sustainment costs would be minimized. The next generation advanced tanker will have a reduced signature and improved defensive systems to permit refueling closer to the target area, thus extending strike aircraft ranges or time on station.

The Mobility Requirements Study (both for 2005 and the next version in development) and ongoing US Transportation Command request prioritization balance and impact demands on air mobility.

The ability to launch, operate, and maintain space vehicles responsively is essential because the United States cannot afford the loss of space-based capabilities or the luxury of waiting months to put a replacement satellite in orbit after a system failure. It will require: (1) robust and responsive spacelift and rapid satellite initialization providing quick-turn, on-demand, assured space access for time-sensitive military operations; (2) orbital transfer vehicles to reposition or boost on-orbit access; and (3) space-based elements of the launch and test range to increase coverage while reducing operations and maintenance costs associated with the ground-based infrastructure. On 1 March 2003, the Air Force Space Command began a year long Operationally Responsive Spacelift Analysis of Alternatives focused on how to put payloads into space on short notice. The capabilities of the other Services have already been factored into spacelift requirements.

Rapid global mobility depends greatly on the following command and control systems described in the "Information Superiority" section of this chapter as well as in Appendix D: Airborne Networking capability, Integrated Broadcast Service, Joint Tactical Radio System, Link 16, and the Transformational Satellite.

Key Programs/Future System Concepts Enabling Transformational Capabilities 14-15:

Near- to Mid-Term (until 2015): Advanced Situational Awareness/ Countermeasures System, Automatic Air Refueling, Autonomous Approach and Landing Guidance, C-17, CV-22, Global CONOPS Synchronization, Integrated Flight Management ATD, Large Aircraft Infrared Countermeasures

Long-Term (past 2015): *Advanced Mobility Concept Aircraft (AMC-X), Advanced Mobility Tanker (KC-X), Advanced Propulsion Systems, Air Launch System, Global Launch & Test Range, M-X Low Observable Advanced SOF Air Mobility Platform, Orbital Transfer Vehicle, Precision Extended Glide Aerial Delivery System, Space Maneuver Vehicle, Space Operations Vehicle*

In addition to these programs and future system concepts under consideration, the Air Force, starting with Operation Iraqi Freedom, has embedded its **Assessment Teams** (also known as Contingency Response Groups), which assess forward airfields in a theater of operations, with the initial ground assault force. These Assessment Teams will implement Integrated Base Defense measures that provide Force Protection across the ground dimension of the Battlespace. This allows a seamless integration between airfield seizure and operations enabling forward airfields to be set up significantly faster than before in theater and thus significantly enhancing the combat power available to the Joint Force Commander and joint operations.

F. Agile Combat Support

Agile Combat Support provides the foundational capabilities operational Air Force Task Forces translate into the responsive, flexible, and precision application of air and space power. It is more than deployed combat capabilities. Agile Combat Support prepares deployed Air Force assets for quick response and sustains engaged forces in persistent operations. More specifically, it entails the following:

- Readying the force by organizing, training, and equipping to produce combat capability across the range of military operations
- Preparing the battlespace by assessing, planning, and posturing for employment in specific mission scenarios
- Positioning the force within the required response timing by assembling modular and scalable capabilities, flowing them incrementally, and establishing effective beddown and force support
- Employing the force by providing immediate launch and/or strike operations, creating right-sized essential generation capacity, and ensuring regeneration of mission capability
- Sustaining the force by maintaining effective capacities of mission support for the duration of operations worldwide beginning on the first day of employment operations
- Recovering the force by accomplishing redeployment and reconstitution
- Ensuring that the instruments of air and space power are tools that can effectively be applied repeatedly

Presently, the Air Force cannot fully accomplish these tasks in a way that maximizes the full potential of air and space power and achieves the "focused logistics" goals of *Joint Vision 2020*. Focused logistics is the ability to provide the joint force the right personnel, equipment, and supplies in the right place, at the right time, and in the right quantity, across the full range of military operations in all conditions—to include CBRNE environments. It will result from revolutionary improvements in information systems, innovation in organizational structures, reengineered processes, and advances in transportation technologies. To address this shortcoming, the Air Force is currently pursuing the following transformational capability:

16. Significantly lighter, leaner, and faster combat support that enables responsive, persistent, and effective combat operations under any conditions

Key Programs/*Future System Concepts* Enabling Transformational Capability 16:

Near-Term (until 2010): Air Force WMD Emergency Response Program, Centralized Intermediate Repair Facilities, Deployable Oxygen System, Deployment Readiness System, Integrated LOGCAT/ GeoReach-Expeditionary Site Planning/Mapping, Expeditionary Combat Support Modules, *Expeditionary Medical Support System*, Full Spectrum Threat Response Program, Global Combat Support System—AF, Integrated Base Defense Security Systems, Joint Biological Agent Identification and Diagnostic System, Joint Biological Point Detection System, Joint Chemical Agent Detector, Joint Chemical-Biological Agent Water Monitor, Joint Container Refill System, Joint GUARDIAN Program, Joint Modular Chemical-Biological Detection System, Joint Service Family of Decon Systems, Joint Service Installation Pilot Project, Joint Service Light NBC Recon System, Joint Service Lightweight Standoff Chemical Agent Detector, Joint Service Sensitive Equipment Decon System, Joint Transportable Collective Protection System, Joint Warning and Reporting System, Regional Supply Squadrons, Restoration of Operations ACTD, Supply Chain Common Operating Picture

Mid- to Long-Term (past 2010): Advanced Planning and Scheduling, *Agile Force Accountability,* Agile Transportation (AT 21) ACTD*, Condition Based Maintenance, Enhanced Human Performance,* Full Spectrum Threat Response, *Future Single Supply System, Ground Contingency Medical Support System, Logistics Financial Management re-design, Medical CBRNE Defense,* Purchasing and Supply Chain Management

Many of the programs and efforts associated with achieving this transformational capability are a part of the Expeditionary Logistics for the 21st Century (eLog21) campaign. This campaign is coordinating the implementation of several major process transformation initiatives that will increase weapon system availability and reduce logistics cost to the warfighter.

The Air Force will also soon develop a separate transformation roadmap to provide effective and efficient combat support for the new Air Force CONOPS (described in Chapter VI) per direction of the new *Air Force Strategic Planning Directive for Fiscal Years 2006-2023.*

Significant Advances During Operation Iraqi Freedom

Preliminary, unclassified "lessons learned" analyses from Operation Iraqi Freedom indicate that the Air Force achieved significant advances in many of the capabilities described in this chapter since Operation Enduring Freedom as well as improvements in joint warfighting. Key examples include:

- **Joint Warfighting:** OIF was the first war that executed a campaign as designed by the Goldwater-Nichols Act of 1986: a truly joint warfighting effort from planning to execution. Air, ground, maritime, and space forces worked together at the same time for the same objective—not just because they occupy the same battlespace. For example, Air Force, Navy, Marines, Army Tactical Missile System and Patriot units, coalition air forces, and space assets were all included in a combined Air Tasking Order. In addition, ground forces were able to bypass major enemy formations because, according to General Peter Pace, (Vice Chairman, Joint Chiefs of Staff), of the "trust our ground forces had in precise and timely airpower." To avoid repeating the mistakes made in Operation Anaconda in Afghanistan, the Air Force enjoyed unprecedented coordination with the land component commander to ensure air and space forces were fully integrated with the Army and Marines, as well as British troops. Two key related initiatives included:
  - **Air Component Coordination Element**. During OIF, an ACCE team was located within each component (land, maritime, and special operations) force headquarters to allow the air component to better integrate air and space power with the operations of the other components to better achieve the Joint Force Commander's objectives.
  - **Ground Warrior Modernization:** During OIF, two-thirds of Tactical Air Control Parties (the airmen embedded in Army ground units for close air support) were outfitted with standardized SOF equipment. This significantly improved their ability to enable time-critical targeting and timely close air support of ground forces.
- **Blue Force Tracking:** Blue Force Tracking is the identification and tracking of friendly forces for the purpose of providing the Combatant Commander enhanced battlespace situational awareness and reducing fratricide. American forces enjoyed unprecedented situational awareness during OIF. Common operating picture capabilities enabled much improved area of responsibility battle management and targeting deconfliction. However, fratricide remains an issue.
- **UAVs:** American forces used multiple Predators during OIF to provide a far more comprehensive operational perspective across the theater to the Combined Air Operation Center by integrating the Predator common operating picture with the Falcon View. The Predator has become a de facto theater ISR asset and has evolved from a "tactical soda straw." They also enabled time-critical targeting via streaming videos to strike platforms.
- **Time-Critical Targeting:** OIF demonstrated the Global Hawk UAV's ability to handle dynamic tasking with actionable intelligence to reduce sensor-to-shooter times down to minutes (though not yet single-digit minutes). In addition, Central Command delegated time-critical targeting decision execution authority to the air components in the theater.

- **Expeditionary Force Modules:** Instead of being reactive and ad hoc, Expeditionary Force Modules, which represent what it takes to open, operate, and maintain a base, were proactive during OIF. This enabled tailored packages to meet the mission.
- **Embedded Contingency Response Groups:** These groups provide the air component a combat advance team to facilitate a full operating capability from a seized or austere airfield. During OIF, they participated in the seizure of airfields and therefore closed the transition seams that existed between airfield seizure (Combined Force Land Component Command) and the commencement of air operations (Combined Force Air Component Command).
- **More Agile Logistics:** Advances in logistics tracking technology, investments in new air and sea lift assets, and the prepositioning of military equipment in the region allowed US forces to deploy with unprecedented speed. In addition, traditional TPFDDs lacked utility because American forces did not know where they were going until the last minute. Therefore, US Transportation Command used a crisis deployment process known as a request for forces deployment order, which entails moving smaller combat units able to begin fighting quickly rather than moving all the pieces of a fighting force at once, as under a TPFDD.
- **Special Operations:** Operation Iraqi Freedom was a coming-out party for Special Operations Forces. During OIF (as well as in Afghanistan), they controlled large areas with limited forces; timely, accurate and relevant ISR; and the strength of rapid, precise airpower. They were a light, yet lethal mobile force and were truly joint in how they operated. In Iraq, special operators were integrated into the theater commanders campaign plan as an independent maneuver element. Strategic, operational and tactical objectives were linked to their operations.
- **Unprecedented command and control:** OIF demonstrated that with the right training, technology, organizations, and concepts of operation, US forces can command and control warfare better than ever before and produce decisive effects faster, farther, and with greater precision than at any time in the history of armed conflict. OIF also demonstrated the incredible effects that advanced technology could have on the battlefield exploiting this unprecedented command and control. Weapons conceived in the 1970s and 1980s, and fielded in the 1990s, are now having a revolutionary effect on combat.
- **Integration of space operations at the strategic, operational, and tactical levels:** For the first time, the Air Force designated a Space Coordinating Authority in the Combined Air Operations Center (CAOC), bringing a senior space advisor and his reachback support network to the Combined Forces Air Component Commander's leadership team.

What the Air Force Needs from the Other Services and Agencies

In addition to the ways the other Services already support the Air Force (described in Chapter III), the Air Force requires additional support to enable these transformational capabilities. This includes (most, if not all, of which is already occurring):

- Jointly developed communications and information systems to satisfy all Services' requirements and to ensure a common operational picture and a single

interpretation of processed information. All Services should jointly pursue common hardware and software development to ensure interoperability and to reduce development, procurement, and overall Operation and Maintenance costs.

- All Services should follow the new Defense Information Systems Agency Net-Centric Operations and Warfare and the Net-Centric Enterprise Services processes. This will ensure better machine-to-machine interfaces and system interoperability between the Services and joint commands.
- A joint fire control system of systems that enables the Joint Force Commander to seamlessly access the sensor-to-shooter assets of all the Services to put a cursor over a target in a timely manner.
- Common, coordinated understanding of ISR requirements of all the Services.
- Coordinated information operations efforts, to include ensuring that all information systems are effectively protected against adversary information operations.
- Continued improved coordination of air operations and combat air support between the Services. This includes coming to a common agreement with the Navy on metrics to measure capabilities packaged in an Air and Space Expeditionary Force and a Carrier Strike Group.
- Coordinated missile defense networks. Air Force missile defense capabilities must effectively combine with the Navy's Aegis Cruiser Ballistic Missile Defense; Army's Ground Based Interceptors, Theater High Altitude Air Defense, and Patriot Advanced Capability–Phase 3 missile systems; and the Marine's TPS-59v3. They must also coordinate with the Federal Aviation Administration, Coast Guard, and Aerostat.
- Effectively detecting cruise missiles will require effective coordination with Navy Aegis Spy Radars and the E-2, the Army Sentinel Radar, the Department of Homeland Security, and counternarcotic air surveillance assets. Destroying cruise missile threats will require effective teamwork with Army Air Defense Artillery as well as Navy/Marines fighters and cruisers.
- Coordination of space control activities with the Army and Navy.
- Continued efforts to minimize airlift demands. This includes increased prepositioned assets, forward based logistics, and leveraging sea and land transportation capabilities to augment or offset the need for air transportation and refueling.
- Improved TPFDD development and interface with US Transportation Command.
- Continued efforts to improve joint training, experimentation, exercises, professional military education, etc.
- Effective coordination on the development of the new Joint Operating Concepts to ensure that the US military can most effectively execute the US National Military Strategy.
- Agreement on the standards by which all Services will provide human resources services to employees. The seamless delivery of human resources services will ensure that the right people are at the right place and time regardless of Service. For example, if the Air Force needs to employ Army or Marine soldiers to help secure an Air Force Base, or position airmen on a naval vessel, there should not be a gap or seam in personnel servicing. In addition, Active Duty, Reserve, Guard, and DoD civilians should receive the same level of customer service, regardless of Service, from requirements to accountability.

- Predictive Sustainability Awareness. Services and Agencies (likely with the Defense Logistics Agency and the Army in the lead) need to coordinate to anticipate support challenges and resolve them before they become showstoppers. This includes developing triggers to determine when commitments are exceeding sustainable levels during surge periods to mitigate impacts and respond quickly.
- Integrated Combat Support Situational Awareness. Services and Agencies need to better define Service/Agency support requirements to properly size the force for major operations to reduce demand for forward presence and be more responsive. This includes integrating multi-Service In Transit Visibility capabilities.
- Coordination on future joint urban operations. The Air Force recently conducted a two-part forum to explore air power's role in future joint urban operations. The forum formed the basis for the ongoing development of a new Air Force urban operations concept of operation. The Air Force looks forward to working with JFCOM and the other Services to eventually integrate this new CONOPS into future joint urban operations.
- Improved coordination with other Services and Agencies on homeland security issues. This includes a broad-based, intelligence-sharing program with the other federal departments and agencies to enhance homeland security.

Appendix E describes how the Air Force is supporting the transformation plans of the other Services.

VIII. Transforming How The Air Force Does Business

The Air Force operates in a world in which the United States has global interests, responsibilities, and commitments. It is a world entering a period of dynamic and rapid change with threats to the United States, its interests, and its people—both at home and abroad. America's enemies are increasingly non-state actors who employ novel and rapidly changing modes of attack and weapons. The Air Force will meet these new challenges because of the ability of Airmen to innovate, adapt, and lead-turn the enemy in the development of operational concepts, doctrine, and tactics. Implementing the warfighter's visions through the development and delivery of forces, systems, and support demands equal flexibility and agility in the Air Force's business operations.

Although many of the business processes have been incrementally reformed and modernized over the last thirty years, the underlying philosophy and basic architecture of these processes have not changed. They are labor intensive and lack the required agility, flexibility, and speed. To sustain the Service's warfighting advantage, the Air Force must ensure that its business processes and operations are efficient and effective, focused on war-fighting capability, and reinforce and support the Air Force's three core competencies, which are the source of its warfighting advantage.

The Air Force business transformation vision for the future is a single, capability-focused enterprise that serves the warfighter's needs and closes the seams dividing the Service's capabilities today. The principal goal of this vision is to fashion a fast, flexible, agile, horizontally integrated business infrastructure that supports and enables fast, flexible, agile, and lethal combat forces. The Air Force must be as business efficient as it is combat effective.

Business Transformation Objectives

The Air Force seeks—relative to the current baseline:

- A twenty percent shift in business operations resources (dollars and people) to combat operations and new/modern combat systems
- Work processes and a work load enabling Air Force personnel to accomplish routine (non-crisis and non-exercise) organizational missions within a 40 to 50 hour work week
- A compression of average process cycle time by a factor of four (relative to current established process baselines)
- An improvement in the effectiveness of operations resulting in higher customer satisfaction ratings
- Empowerment of personnel and enrichment of job functions

The objectives are derived from the Secretary of Defense's direction to shift resources from the "bureaucracy to the battlefield" while continuing to attract innovative and creative thinkers in the DoD. Thus, a staff with reduced resources necessitates an enterprise-wide business transformation.

Measuring the success of these business transformation objectives will be a considerable challenge for the Air Force. The success of business transformation should not be measured solely in terms of reductions in staff or the number of hours worked per week or measured against the standards of commercial industry. In addition to these benchmarks, the Air Force must realize how best to enable its combat capabilities and measure its products and services against what is needed to enable joint combat capabilities. A mindset change is essential to success.

Business Transformation Background and Leadership

In July 2003, the Secretary of the Air Force chartered the **Air Force Business Management Modernization Program (BMMP)**, which parallels its DoD counterpart. The DoD BMMP had reached an important milestone in April 2003 with the completion of the Business Enterprise Architecture. This Architecture provides the framework for managing the continuing transformation of DoD business processes and systems (both financial and non-financial).

To guide Air Force business transformation and to achieve the aforementioned objectives, the Secretary also created a **Senior Business Modernization and Systems Integration Group (SBIG)** to provide oversight of Air Force BMMP initiatives, Enterprise Resource Planning-related implementations, and other business transformation.

Business Transformation Execution

In addition to the SBIG, the Air Force chartered Business Domain Owners and an integration office to achieve the business transformation vision**.** The domains and their owners are:

- Finance, Accounting Operations & Financial Management (SAF/FM)
- Strategic Planning and Budgeting (SAF/FM and AF/XP)
- Acquisition (SAF/AQ)
- Human Resource Management (SAF/MR and AF/DP)
- Installations and Environment (SAF/IE)
- Logistics (AF/IL)
- Technical Infrastructure (AF-CIO and AF/XI)
- Health Services (AF/SG)

The Air Force Business Domain Owners will interface with their DoD domain counterparts to:

- Lead transformation of their domain business area
- Refer cross-domain issues to the Air Force Business Modernization and Systems Integration (BMSI) Office for resolution
- Provide a full-time domain subject matter expert to the Air Force BMSI Office to assist in the integration activities
- Establish governance within the domain
- Advocate and support change within the business domain and reengineer business processes
- Comply with guidance, standards, and policy issued by the Air Force BMSI Office

The **Air Force BMSI Office** serves as the Service integrating and coordinating arm with the OSD BMMP, manages Air Force enterprise solutions, and ensures all enterprise-wide activities are coordinated and consistent with the Air Force Enterprise Process View, Air Force Enterprise Architecture and technical standards. It is responsible for developing options and evaluating alternatives to maximize the efficiency of the Air Force Enterprise by identifying the expected value of proposed solutions and providing recommendations to the senior Air Force leadership. The Air Force Business Domain Owners will use their functional representatives at the Air Force BMSI Office to integrate and coordinate the development of Air Force enterprise business capabilities across all functional domains and their synchronization with Air Force operational processes.

Business transformation objectives will also be accomplished by promoting strategies that leverage the flexibility and innovation of US Small Businesses. The Air Force recognizes that Small Businesses continually serve as market laboratories for conceiving, testing, and demonstrating innovative ideas that directly support the Secretary of Defense's business transformation vision.

Tools for Business Transformation

A wide range of tools, techniques methods, approaches as well as extensive skill, experience and exposure to new ways of thinking will be needed to bring about the envisioned transformation of Air Force business processes. The Air Force is just beginning the execution phase of business transformation. This section highlights some of the initial tools.

Enterprise Process View (EPV)

Establishing the Air Force BMMP, with a SBIG, and a BMSI Office, provides a governance structure from which to promote and achieve the Air Force business transformation vision. It is equally important to provide a logic, framework, and enterprise context with which to guide relevant transformation projects. Consequently, the Air Force developed a conceptual architecture for an enterprise-wide approach to business transformation that would support the three Air Force core competencies. The EPV creates a single enterprise perspective that is critical to supporting a capabilities-based approach to business transformation. An EPV will instill a disciplined enterprise process orientation that is capability-focused rather than individual platform, program, system, or function focused. In order to optimally reinforce the Service's core

competencies, the Air Force needs to understand how its core business processes across the enterprise integrate to support the development of warfighting capabilities. This new view provides a way for the Service to organize its thinking, analysis, and decision-making around the warfighting capabilities.

The EPV captures the Air Force's core processes, those processes that provide governance of the core, and those that enable the core process to work. The core processes are those that most directly strengthen and reinforce the three core competencies. In the near term, this will discipline Service business transformation efforts. For the long term, it will provide a context to: (1) standardize, rationalize, and improve processes across the Air Force; (2) guide enterprise architecture efforts; (3) provide a framework to rationalize multiple and redundant processes, tools, and systems; and (4) facilitate knowledge sharing and collaboration—all focused on one goal: sustainable warfighting competitive advantage.

Business Enterprise Architecture

The Air Force BMSI will employ the EPV in the development of the Air Force Business Enterprise Architecture. This architecture will integrate existing transformation efforts with a focus on identifying cross-domain efforts and targets for enterprise solutions. The Air Force BMSI will leverage this architecture in the development of a phased road map to enable the Air Force to proceed rapidly from pilot programs to an incremental enterprise-wide modernization supported by commercial off-the-shelf components.

Enterprise Solution Integration Strategy

In order to realize its charter from the Secretary, the Air Force BMSI will develop an Enterprise Solution Integration Strategy that will support the issuing of guidance and standards necessary to achieve integrated Air Force-wide enterprise solutions across all business domains where such solutions and related business practice reforms are ongoing or proposed.

IX. Long-Term Transformation: Future Challenges for Science and Technology

Attaining solutions for the warfighter depends in large measure on research and development. Through robust investment and deliberate focus in science and technology, the Air Force invigorates its core competency of technology-to-warfighting. The Air Force is improving its S&T planning and collaboration with other Services and Agencies to ensure that it:

- Encourages an operational pull that conveys to the S&T community a clear vision of the capabilities the joint commander needs in the future
- Addresses the full spectrum of future needs in a balanced and well thought-out manner
- Enhances the Air Force's ability to demonstrate and integrate promising technologies

As already discussed, the Air Force Vision challenges the Service to maintain global air and space power supremacy, not only today but also well into the 21st Century. This vision realizes that while the United States possesses a world-class Air Force, constant S&T vigilance is essential to maintain its superiority and better meet the security demands of an increasingly complex world. In a broad sense, long-term Air Force S&T is focused on: (1) moving the Service's capabilities from a theater to a global focus; (2) integrating air, space, and information capabilities to take advantage of the synergy between these three domains; (3) rapidly projecting capability to anywhere on the Earth and into space while still retaining the ability to be expeditionary; (4) creating effects on demand anywhere, anytime; and (5) creating a rapidly composeable environment able to accurately replicate potential battlespace anywhere in the world through the use of rapid scenario generation tools—and providing that ability to the warfighters in a timely manner.

The Air Force developed six long-term challenges to help focus the S&T investment beyond the 2020 horizon. The challenges are deliberately expressed in broad terms to avoid specifying solutions that could limit the scope of future S&T research. The six long-term challenges are:

- **Finding and Tracking:** *provide quality information from anywhere in near real-time*
- **Command and Control:** *monitor, assess, plan, and direct operations anywhere, from anywhere*

- **Controlled Effects:** *create precise effects, rapidly, anywhere, any time, for as long as required*
- **Sanctuary:** *allow friendly forces to operate anywhere with the lowest risk possible*
- **Rapid Air and Space Response:** *respond as quickly as necessary and relocate rapidly*
- **Effective Air and Space Persistence:** *sustain force application and supply flow as long as required*

This chapter briefly outlines each challenge and notes some exciting new possibilities that long-term Air Force S&T is exploring over the next few decades.

Finding and Tracking

Precision is one of the fundamental requirements that underpin the effectiveness of air and space power. To be precise in the application of force requires knowledge. For this reason, the United States needs the ability to provide a decision maker target quality information from anywhere in the world in near real-time at any moment in time, something not possible today. In addition, there are items that cannot be reliably found and tracked today even when sensors are present. Although finding and tracking is not the sole purview of the Air Force, airborne and space-borne sensors will fill key roles.

In the long-term, Air Force S&T is exploring exciting possibilities that could be derived from extrapolations of current technologies. One is to control the availability of latent sensory data and integrate it with real-time detection, which would enable unprecedented characterization of potential targets. Another is to understand how to net large arrays of individual sensors to create nearly invulnerable sources of information. Yet another possibility is to dispatch at will a swarm of very small sensors to enter tunnels, look under camouflage cover, listen behind lines, electronically eavesdrop, or sniff out chemical and biological presence or threats. This would put eyes, ears, noses, and antennas wherever they are most needed for threat warning, assessment, and, if armed with high-energy-density munitions, even neutralization. The Air Force is also addressing the scientific barriers to miniaturization of components through coordinated research on micro mechanics nanoelectronics, nanopropulsion, and the role of smart skins and flight dynamics. This would enable the development of sensors at the molecular level. These microscopic sensors or "sensor dust" could be used for novel swarm detection, tagging, tracking, and the identification of difficult targets. This could lead to major extensions of present eyes-in-space through air launch on demand of both "nanosats" and swarms of long endurance mini UAVs. Such capabilities would enable reductions in time and extensions in space to achieve target quality information in near real-time. The Air Force is also exploring techniques for assessing global conditions and events so that the United States can be forewarned of potential adversarial actions.

Command and Control

Control of military force is central to the American way of war. The United States will always need to improve its ability to gather and assimilate vast amounts of data, discern pivotal information and communicate knowledge to the right place at the right time.

Inherent in this capability is the need to gather data from multiple sources, fuse that data, and expertly assimilate and display critical information to give joint warfighters knowledge when they need it, where they need it, and how they need it. While the American military has made significant progress in the command and control area, there is a long way to go.

In the long run, the Air Force is trying to find a way to move knowledge through a global grid in order to develop a true "reach anywhere" command and control ability. The Service is focusing the cross-disciplinary research areas of joint battlespace infosphere, information flow, information assurance, network modeling, and monitoring local information systems. Equally intriguing is the potential of a "master caution panel" for the joint commander that would proactively tap him on the shoulder whenever a new critical situation developed in the battlespace and offer alternative courses of action. This could significantly help the commander control the tempo of the conflict. Research areas include: bio, nano, quantum information processing, storage and retrieval; intelligent dynamic software agents; human cognitive enhancement; and high-level fusion tools and algorithms. The Air Force is also pursuing quantum computing with a breakthrough potential of atomic-level computing a million times faster than today's silicon chip. If realized, this would leap the command and control infosphere into the realm of contextual interpretation and proactive projection of alternate futures from which the commander could choose, keeping the tempo of conflict ahead of any adversary. In addition, the Air Force is exploring advanced technological means in artificial intelligence, neural networks, and fuzzy logic capabilities to apply to business and battlefield mission areas to keep the United States inside the opponent's decision cycle in the long-term.

Controlled Effects

Military power is a coercive force. The threat of the destruction of national resources may compel an adversary to reevaluate strategic intent and goals. To achieve this into the foreseeable future, the United States must be able to create precise effects rapidly, with the ability to retarget quickly, against complex target sets anywhere, anytime, for as long as required. It also needs the ability to tailor the type and amount of energy on target to create the desired effect, whether it is lethal or non-lethal, precise or dispersed. While there has been significant progress in the past decade with precision, directed energy, and non-lethal weapons, there is yet a long way to go to reach the full potential of these abilities.

Long-term Air Force S&T efforts in this area are exploring various promising possibilities to achieve real control of battlespace effects. For example, the Air Force is beginning to understand how to create temporary and even reversible effects. The emergence of information operations techniques has added yet another dimension of capability. These capabilities are central to the strategic concept of Rapid Aerospace Dominance and enable the idea of Rapid Aerospace Strike. Air Force S&T is also exploring the possibility of putting a warning energy "spot" on any target worldwide that could be rapidly followed with varying levels of effects. This could significantly enhance the value of conventional deterrence to the President, the Secretary of Defense, and the Joint Force Commander. Another area of possible breakthrough deals with solid-state directed energy. If the generation of large quantities of heat could be managed, the Air Force could develop highly effective, cheap, high power energy weapons.

The Air Force is also looking for ways to provide measured global force projection via high-powered microwaves (HPM). Within HPM, it is investigating how to enhance the lethality of HPM systems, conformal array antennas (in order to put these systems on tactical platforms), and air breakdown mitigation (the physics of propagating HPM through the atmosphere). The Service is also identifying enabling technologies for directed energy for "from tap on the shoulder, through to toast" those we wish to control.

In addition, the Air Force is aggressively identifying areas of application of an extremely high density material recently unveiled by Air Force research, N-5, the first new stable compound of Nitrogen discovered in over 100 years. Combining this with tailored-shape munitions manufactured from nano-particles, whose virtually all-surface structure yields unprecedented "burn-rates" (extreme explosiveness), promise far greater control of battlespace effects than previously imagined.

Sanctuary

Because the American way of war is to take the fight to the adversary, it is natural that the United States should expect future adversaries to develop anti-access strategies that place deployed US forces at unacceptable risks, even within the United States. The US military must be able to protect its total force from natural and man-made hazards or threats, allowing it to operate anywhere with the lowest risk possible at affordable costs in an increasingly dangerous environment. Inherent in this function is the ability to take appropriate actions to include threat neutralization, CBRNE protection, and information operations. The long-term challenge to the United States is to be able to continue to counter these constantly evolving efforts by potential adversaries. Staying one step ahead of an adversary in a rapidly evolving technological world will challenge Air Force S&T for some time to come.

Some key Air Force S&T efforts in this area include producing a safe source of fuel from water and engaging precisely without kinetic weapons. Both could dramatically increase survivability inside a threat envelope through true dispersed operations. In other domains, the Air Force is exploring new abilities to assure rapid, cheap access to space to provide much more flexibility for protecting increasingly important space assets. It is also looking at how to provide an invulnerable force so that the total force is protected from both natural and man made threats. Areas of research within electromagnetic spectrum manipulation include: stealthy materials, camouflage skins, active camouflage, and dynamic jamming.

The Air Force has also begun work in nanoelectronics to enable more versatile payloads that could be "air-launched" for rapid, cheap space-launch as well as swarms of UAVs and UCAVs of the future. The potential appears limited only by the rate at which the Air Force is choosing to progress in spiral advances towards greater sensing, time on target, and destruction capability for less weight, delay, and cost. The promise for the future is a ring of awareness, then protection, then safety around sites of our choice, or denial of the same to an adversary.

Rapid Air and Space Response

There will always be political and policy reasons to go "forward." It is for this reason that the ability to move quickly anywhere in the world is critical to the effectiveness of military power. Part of the challenge to Air Force S&T will be to meet the Vision's mandate to reduce the forward footprint by fifty percent by the year 2020. Another aspect of rapid air and space response is access to space. Today the United States cannot quickly get into space, and US space presence is not assured as space assets grow more vulnerable over time.

Air Force S&T is examining possible solutions to these problems as technology matures. For example, it is looking at ways to collect or generate large quantities of energy on orbit in order to rely on space-based platforms for more missions and provide a greater degree of true global presence. This would change many equations about traditional ideas of rapid response. In addition, the Air Force is pursuing research to enable rapid global reach. One key area of basic research is in Advanced Structural Systems, which includes research in adaptive structures, structural efficient materials based on beryllium, magnetic flow paths and nozzles, and lightweight, high temperature structures.

Air Force S&T is also engaged in plasma dynamics studies that have already demonstrated significant air-drag reduction on vehicles and missiles. If such plasmas can be generated with sufficient energy efficiency on leading edges of aircraft or missiles, they can significantly increase range and reduce time to target, aircraft time-on-target, and fuel consumption. Pulse-detonation rockets have demonstrated changes in pressures and wave-speeds in rocket engines that project be increased payload by up to 50 percent in boost, upper stage, and orbit transfer, all at increased reliability.

Effective Air and Space Persistence

Closely linked to the ability to respond is the military imperative to persist once there. Persistence applies to the ability to keep an adversary at risk in his own territory for as long as necessary, to do "air and space occupation." A key aspect of American deterrent credibility is the belief by the adversary that the United States will persist until it capitulates. While this is possible today under certain circumstances, Air Force S&T is focusing on how to achieve this in all circumstances, anywhere on the globe in air and space, against all potential threats.

Some areas that long-term Air Force S&T is examining include: (1) on-orbit maintenance, repair, and upgrade of space systems to enable true persistence; (2) "recovering" space vehicles on demand, to protect space assets as well as improve the currency of technology in space; (3) routinely operating at 30 to 70 miles above the earth to give the Joint Force Commander unparalleled operational flexibility and persistence at very low risk; (4) dramatically reducing the time to move anywhere on the globe from CONUS not only to make dramatic improvements to America's ability to respond, but also to create many opportunities for ways to persist.

In addition, access to space is one of the areas the Air Force is researching within this long-term challenge. Various architectures are being studied for future constellations. This research would include satellite clustering; adaptive satellites; micro, nano, and pico satellites; and miniature satellite mechanical systems.

Revolutionary polynitrogen compounds for all-nitrogen propellants, strained-ring hydrocarbons for liquid boosters, and energetic monopropellants for launch and satellite propulsion are converging on the goal of reducing space delivery costs (for a fixed payload) by half at increased burn rates. This, combined with a miniaturization-science for space (to reduce weight to orbit, where applicable) may significantly enhance space persistence, with spin-off enhancements to UAV and UCAV persistence.

X. Conclusion

It is an exciting time for the Air Force. It is engaged in developing new strategies and new concepts of operation to meet an entirely different set of challenges and vulnerabilities. Technology is creating dynamic advances in information systems, communications, and weapon systems, enabling the joint commander to understand the enemy, deploy forces, and deliver more precise effects faster than ever before. Airmen are more educated, more motivated, and better trained and equipped than any time in the past.

The Air Force is fully committed to the transformation process and to maximizing joint combat capabilities. It is using the Secretary of Defense's construct, expressed by the new defense strategy, the Transformation Planning Guidance, FY03-07 Defense Planning Guidance, and the 2001 QDR's six operational goals for transformation and risk framework to guide its transformation efforts. The *Air Force Transformation Flight Plan* lays out the Service's ongoing transformation efforts, which, in concert with the other Services, will help achieve the effects required by the Joint Force Commander in the changing security environment.

The Air Force of today is facing numerous challenges within the new security environment. Networking of air, space, and ground systems is limited. The amount and type of ISR assets needed for time-critical and simultaneous targeting in most cases is limited. Legacy air capabilities are vulnerable to the next generation of advanced air defense systems. Rapidly striking anywhere on the globe and conducting persistent operations is very difficult. In most cases, the only option to affect a target is to destroy it with kinetic weapons, which is not appropriate in all situations. Critical information and space systems are vulnerable to attack. The United States has a limited capability to affect adversary C4ISR and deny space to adversaries if necessary. In most cases, forces cannot be deployed abroad in a timely manner. American territory and forces are also highly vulnerable to ballistic and cruise missile attacks. The threat from the continued proliferation of chemical, biological, radiological, and nuclear weapons creates a continuous need to ensure that US forces can survive, fight, and win in a contaminated environment.

In overcoming these shortcomings, the ongoing transformation of the Air Force will help enable the Joint Force Commander to:

- Achieve decision cycle dominance to strike adversaries before they can mount an effective defense
- Deny sanctuary to adversaries through time-critical targeting
- Design campaign actions based on desired national security outcomes
- Use smaller forces to disable an adversary rather than having to destroy it with mass attrition
- Maximize the power, lethality, and flexibility of a truly joint force
- Successfully neutralize mobile targets
- Integrate air, space, and land systems across all Services
- Predict and preempt adversary actions when and where we choose

- Deploy with significantly smaller combat support footprints
- Penetrate and defeat the next generation of advanced air defense systems to sustain air superiority into the foreseeable future
- Strike targets anywhere on the globe in a timely manner
- Affect targets short of destroying them
- Protect its information systems
- Disrupt adversary C4ISR–effectively making the enemy fight blind, deaf, and dumb
- Protect space systems and deny space to adversaries if necessary
- Rapidly deploy forces abroad
- Defend against ballistic and cruise missile attack
- Protect resources on the ground for forces both within the United States and abroad

In turn, these capabilities strongly support DoD's transformation goal, articulated in the Transformation Planning Guidance, to produce military forces capable of the following type of operations by the end of the decade:

- Standing joint force headquarters will conduct effects-based, adaptive planning in response to contingencies, with the objective of defeating enemy threats using networked, modular forces capable of distributed, seamlessly joint and combined operations.
- US forces will defeat the most potent of enemy anti-access and area-denial capabilities through a combination of more robust contamination avoidance measures, mobile basing, and priority time-critical counterforce targeting.
- US forces will leverage asymmetric advantages to the fullest extent possible, drawing upon unparalleled C4ISR capabilities that provide joint common relevant operational situational awareness of the battlespace, rapid and robust sensor-to-shooter targeting, reachback, and other necessary prerequisites for network centric warfare.
- Combined arms forces armed with superior situational awareness will maneuver more easily around the battlefield and force the enemy to mass where precision engagement capabilities may be used to maximum effect.

These capabilities will not only revolutionize high intensity combat operations, but also enable the United States to face new non-conventional threats and the future security environment. For example:

- Rapid global attack, rapid global mobility, persistent ISR, standoff, ballistic and cruise missile defense, information operations, and stealthy air defense penetration capabilities will counter various anti-access strategies by adversaries.
- Information operations capabilities will protect critical C4ISR systems and networks against adversary attacks and counter adversary PSYOP campaigns.
- Space superiority capabilities will protect critical space assets against growing adversary threats to them.
- Information superiority capabilities will counter advanced dispersal and deception techniques and enable tracking of targets under the cover of night and in adverse weather.
- Information superiority, non-lethal, and rapid global mobility capabilities will greatly enhance future urban operations.

- Rapid global attack, loitering munition, information superiority, and rapid global mobility capabilities will be essential in the ongoing global war on terrorism.
- Ballistic and cruise missile defense and force protection capabilities will protect US forces from new technologies available to adversaries and defend the US homeland.
- Agile combat support capabilities will enable US forces to conduct responsive, persistent, and effective combat operations under any conditions, to include CBRNE environments.
- Predictive Battlespace Awareness capabilities will significantly mitigate the unpredictability of threats in the new security environment.
- Information superiority, rapid global mobility, agile combat support, and rapid global attack capabilities will significantly mitigate the greatly reduced access to forward bases.

In addition to developing capabilities, the Air Force has robust strategic planning, innovation, and long-term S&T processes in place to support the development of these transformational capabilities. It is creating flexible, agile organizations to facilitate transformation and institutionalize cultural change. The Air Force is transforming the way it educates, trains, and offers experience to its airmen so they understand the nature of the changing security environment and are encouraged to think "outside the box." It is continuing the transformation of how it integrates the Air National Guard, Air Force Reserve, and civilian force with its Active Duty force. The Air Force is continuing to transform into a capabilities-based force through the new CONOPS and the CRRA. It is working with the Joint Staff, OSD, and the other Services and Agencies to improve joint warfighting and develop the new Joint Operating Concepts.

The Air Force will always excel at providing air and space focused capabilities to the joint warfighter, while enhancing the capabilities of soldiers, sailors, and marines. The diversity and flexibility of Air Force efforts and capabilities through concepts of operation, technology, and organizational structure provide unparalleled value to the Nation and make the whole team better. DoD must integrate the existing capabilities of the Services in a way that is most efficient and effective to address the rapidly changing security environment. The Air Force will continue to work with the rest of DoD to develop the new Joint Operating Concepts and keep transformation focused to provide the capabilities required for the Nation in the 21st Century.

The key themes of the Flight Plan can also be found in the Air Force pamphlet "The Edge: Air Force Transformation."

Appendix A:
TPG GUIDANCE FOR SERVICE TRANSFORMATION ROADMAPS

This appendix reproduces the text of Appendix 3 of the Transformation Planning Guidance, which details OSD requirements for Service transformation roadmaps beginning with this version. Where applicable, it cites the chapters and sections where the requested information can be found within the Flight Plan in bold parentheses.

As described in the body of the TPG, the Services and Joint Forces Command will build transformation roadmaps to achieve transformational capabilities (as represented in the six operational goals) in support of joint operating concepts and supporting operations. The transformation roadmaps will plot the development of capabilities necessary to support these concepts and will serve as baseline plans for achieving the desired joint operating concepts. They will outline the concrete steps organizations must take in order to field capabilities for executing joint and Service concepts.

To ensure that the transformation roadmaps provide a level of consistency for the purpose of comparison and analysis, it is important that the roadmaps adhere to certain fundamental guidelines. The updated transformation roadmaps will:

- *Use the definition of transformation presented in this guidance;* **[See Chapter II]**
- *Utilize timelines consistent with the development of joint operating concepts as explained in the body of this document;* **[See Chapter III]**
- *Describe how the organization plans to implement transformational architectures for future operating concepts, consistent with the joint operating concepts and supporting joint and service mission concepts, to include:*
  - *When and how capabilities will be fielded;*
    - *Identify critical capabilities from other Services and Agencies required for success;*
    - *Identify changes to organizational structure, operating concepts, doctrine and skill sets of personnel.*

  [See Chapters III and VII]
- *As possible, include programmatic information that includes appropriation breakouts through the FYDP necessary for the desired capabilities;* **[See separate classified annex]**
- *Unclassified or collateral roadmaps will be supplemented with a compartmented annex when required to expand identification of key capabilities and fully represent the spectrum of Service and Agency capabilities.* **[Briefing to be presented to Director, OFT]**

A central element of transforming our force is interoperability–the ability to bring all relevant information and assets to bear in a timely, coherent manner. All roadmaps will directly address the interoperability priorities listed on page 16 of [the TPG]. Additionally, Services will explicitly identify initiatives undertaken to improve interoperability in the following areas: deployment of a secure, robust and wide-band network; adoption of "post before process" intelligence and information concepts; deployment of dynamic, distributed, collaborative capabilities; achievement of data-level interoperability; and deployment of "net-ready" nodes of sensors, platforms, weapons and forces.

Roadmaps will identify plans for achieving these critical capabilities by ensuring that:

- *Systems are capable of participating in a Joint Technical Architecture collaborative environment;*
- *Systems are tested and evaluated to determine actual capabilities, limitations, and interoperability in realistic Joint Warfare scenarios and in performing realistic missions;*
- *New C4ISR, weapons and logistics systems incorporate* [Internet Protocol] *IP-based protocols;*
- *Systems are capable of "post before processing" functionality;*
- *Selected legacy systems are retrofitted with these capabilities.*
  [See Appendix B]

In addition to adhering to the guidelines above, the roadmaps will address plans to implement other aspects of transformation to include:

- *Incentives to foster concept-based experimentation, the use of prototyping methodologies, and development of training and education programs;* **[See Chapter IV]**
- *Information superiority, the identification and employment of all its elements, how it should be represented in war plans and joint experimentation, and how to achieve it;*
  [See Chapter VII, Section A and Appendix B]
- *Seamless integration of operations, intelligence and logistics;* **[See Appendix B]**
- *Support Standing Joint Force Headquarters and joint command and control;*
  [See Appendix B]
- *Metrics to address the six transformational goals and transformational operating concepts*;
  [See Chapter VI]
- *Transformational intelligence capabilities, specifically those mentioned on page 16 of [the TPG];*
  [See Chapter VII, Section A—especially regarding "Predictive Battlespace Awareness" and Appendix B]

And how experimentation programs meet the TPG experimentation criteria (on page 17-18 of [the TPG]) and support the priorities for experimentation. **[See Chapter IV]**

Appendix B:
ADDITIONAL DETAILS REQUIRED BY TRANSFORMATION PLANNING GUIDANCE

This appendix includes most of the specific details about ongoing and planned efforts in the Air Force required by Appendix Three of the TPG. They are included here because their scope and detail did not fit the broader, more strategic level focus of the body of the Flight Plan.

The information is organized in three sections.

- The first section addresses "the interoperability priorities listed on page 16 of the TPG."
- The second section addresses the following guidance from Appendix III on Service interoperability efforts:
  A central element of transforming our force is interoperability–the ability to bring all relevant information and assets to bear in a timely, coherent manner....Additionally, Services will explicitly identify initiatives undertaken to improve interoperability in the following areas: deployment of a secure, robust and wide-band network; adoption of "post before process" intelligence and information concepts; deployment of dynamic, distributed, collaborative capabilities; achievement of data-level interoperability; and deployment of "net-ready" nodes of sensors, platforms, weapons and forces.
  - *Roadmaps will identify plans for achieving these critical capabilities by ensuring that:*
    - *Systems are capable of participating in a Joint Technical Architecture collaborative environment;*
    - *Systems are tested and evaluated to determine actual capabilities, limitations, and interoperability in realistic Joint Warfare scenarios and in performing realistic missions;*
    - *New C4ISR, weapons and logistics systems incorporate IP-based protocols;*
    - *Systems are capable of "post before processing" functionality;*
    - *Selected legacy systems are retrofitted with these capabilities.*
- The third section addresses the following TPG guidance on Air Force efforts regarding information superiority, to include "*the identification and employment of all its elements, how it should be represented in war plans and joint experimentation, and how to achieve it.*"

For convenience, the following graph charts the primary Air Force interoperability efforts discussed in the first two sections of this appendix associated with the information required by the Transformation Planning Guidance.

TPG Requirement	Associated Air Force Efforts
INTEROPERABILITY PRIORITIES on p 16	
Standard operating procedures and deployable joint command and control processes, orgs, and systems for Standing Joint Force HQ	AOC Formal Training Unit, Command and Control Constellation, Distributed Ground System-neXt, Warfighting HQ
Common Relevant Operating Picture for joint forces	Family of Interoperable Operational Pictures, Single Integrated Air Picture, Multi-Sensor Command and Control Aircraft, Combatant Commanders Integrated Command and Control System
Enhanced ISR	Distributed Common Ground System, Network Centric Collaborative Targeting, National Tactical Integration, Integrated Broadcast Service, Extended Tether Program, ISR Management, National Electronic Intelligence into Distributed Common Ground System, Project SUTER, Space-Based Radar, UAVs, Multi-platform Radar Technology Insertion Program, Command and Control Constellation, Automated ISR, National Tactical Integration, Integrated Broadcast Service, Global Broadcast Service, Multi-Sensor Command and Control Aircraft, Space-Based Infrared System, Multi-Platform Common Data Link, Advanced Wideband Terminal
Selected sensor-to-shooter linkages prioritized by contribution to the Joint Operations Center	Combined Air Operations Center, Multi-Sensor Command and Control Aircraft
Reachback capabilities that provide global information access	Airborne Networking capability, Bandwidth Sharing, Multi-Sensor Command and Control Aircraft, Distributed Common Ground System
Adaptive mission planning, rehearsal, and joint training linked with C4ISR	Most of the programs/future system concepts discussed in Chapter VII, Sections A and F; Distributed Mission Operations, Distributed Mission Training; Joint Synthetic Battlespace, Joint Mission Planning System
INTEROPERABILITY INITIATIVES in Appendix Three	
Deployment of a secure, robust, and wideband network	Laser communications (Transformational Satellite, Joint Tactical Radio System Wideband Networking Waveform, Bandwidth Sharing, Quality of Service, Distributed Common Ground System, Combatant Commanders Integrated Command and Control System
Adoption of "Post Before Process" intelligence and information concepts	Distributed Common Ground System, ISR—Management, Multi-Sensor Command and Control Aircraft
Deployment of dynamic, distributed, collaborative capabilities and achievement of data-level interoperability	AOC as a weapon system, Link-16, Joint Tactical Radio System, Multi-Sensor Command and Control Aircraft, AF Transformation Center, Tactical Data Link Roadmap, Army Deep Operations Center functionality embedding into the Family of Interoperable Operational Pictures, Leadership of JEFX process, Standing Joint Force HQ prototype, Battle Management Command and Control, SIPRNET Portal, Airborne Networking Management, Command and Control Constellation, Global CONOPS Synchronization, Distributed Common Ground System, Multi-Platform Common Data Link
Deployment of "Net-Ready" sensors, platforms, weapons, and forces	AWACS Block 40/45 Upgrade, Joint STARS Attack Support Upgrade and Improved Data Modem, Distributed Common Ground System, numerous efforts associated with UAVs/UCAVs, Situational Awareness Data Link Gateway, Digital Imagery Request and Distribution System (BRITE), Space-based Radar, Adaptive Joint C4ISR Node ACTD, Agile Transportation (AT 21), Joint Tactical Radio System, Multi-Sensor Command and Control Aircraft, Roll-on Beyond Line of Sight Enhancement

TABLE 4: Mapping Air Force Efforts with TPG Interoperability Requirements

Addressing TPG's "Interoperability Priorities"

This section outlines Air Force efforts that support each of the interoperability priorities listed on page 16 of the Transformation Planning Guidance.

Standard Operating Procedures and Deployable Joint Command and Control Processes, Organizations, and Systems for the Standing Joint Force Headquarters

Future Air Force Component theater battle management command and control systems will meet Global Information Grid Capstone Requirements Document requirements to support interoperability with C4ISR and information systems and sources and those developed in the future for US, allied, coalition (multinational), and joint forces and Agencies. Deployable Air Force command and control systems are designed to be interoperable with allied and host nation command and control systems to support combined joint operations. Database standardization, digital production, and semantic tagging of data and information are critical enablers for operating in this multi-level security environment.

The Air Force **Air and Space Operations Center (AOC) Formal Training Unit** reinforces standard operating procedures for joint command and control processes, organizations, and systems. Training joint common process standards for Air Tasking Order generation and dissemination allows integration with the current and future command and control and information systems of all other expeditionary command and control nodes to enhance AOC processes and functions. Joint and combined command and control exercises, such as Blue Flag and Ulchi Focus Lens, further refine standardized tactics, techniques, and procedures, securing essential Service core competencies while ensuring cross-functional compatibility during worldwide contingencies.

The Air Force **Command and Control Constellation** infrastructure and communications architecture will be an open-architecture, Global Information Grid (GiG)-compliant network capable of serving all command and control mission applications. New command and control systems will identify and use common standards for data and metadata presentation. These systems will also comply with applicable IT standards contained in the DoD Joint Technical Architecture and the security standards of the Air Force Department of Defense Intelligence Information System. All of the system's data that will be exchanged, or has the potential to be exchanged, shall be tagged in accordance with the current Joint Technical Architecture standard for tagged data items (Extensible Markup Language), and tags will be registered in accordance with the DoD Extensible Markup Language Registry and Publisher's Clearinghouse policy and implementation plan. The network will be designed to interoperate with compatible future to-be-determined systems.

The proposed **Warfighting Headquarters** construct (detailed in Chapter V) will enable the Air Force to proactively integrate with the proposed Standing Joint Force Headquarters while evolving to a fully joint air and space headquarters of the future.

Common Relevant Operational Picture for Joint Forces

The Common Relevant Operational Picture will present timely, fused, accurate, and relevant information that can be tailored to meet the requirements of the joint force commander and the joint force. The Air Force is working to achieve this through their **Family of Interoperable Operational Pictures** effort. The Air Force is also supporting JFCOM's Joint Interoperability Plan to achieve interoperability priorities, including the Common Relevant Operational Picture.

The Family of Interoperable Operational Pictures is a multi-Service program with new funding provided by OSD that will close the seams between existing legacy C4ISR systems and extend the capability of systems under development in order to exploit the full data collection and management abilities of current C4ISR assets. In order to provide an all-source picture of the battlespace containing actionable, decision-quality information to the warfighter through a fusion of existing databases, it will implement data-sharing and fusion among heterogeneous, stovepiped systems in support of both operational and tactical users. It will facilitate the establishment of interoperability standards and architectures to guide future acquisitions. The Air Force is the lead agent for this program and serves as the systems engineer for Joint Forces Command in coordinating joint battle management command and control programs.

The **Single Integrated Space Picture** will provide global and regional awareness of space forces to the warfighter to enable the Air Force to command and control space forces and present space forces to support effects-based operations. It will evolve into a seamless component of the Family of Interoperable Operational Pictures, along with a Single Integrated Air Picture, Single Integrated Ground Picture, Single Integrated Maritime Picture, Common Relevant Operational Picture and Common Tactical Picture.

The **Multi-Sensor Command, Control Aircraft (MC2A)**, designated the E-10A, is the next generation wide area surveillance platform designed to provide a near real-time, horizontally integrated view of the air and surface battlespace through the use of advanced sensors, network centric systems and high-speed, wide band communication systems. It will provide a focused Air Moving Target Indicator capability for cruise missile defense, robust Ground Moving Target Indicator capabilities, and an open systems architecture to facilitate Battle Management Command and Control. The MC2A will achieve decisive operational capability through the rapid integration of information from manned, unmanned, and space-based sensors. The E-10A is a key enabler of joint rapid decisive operations and the joint theater air and missile defense architecture. The aircraft will also be a key node of the Multi-Sensor Command and Control Constellation, which will enable the horizontal integration of ground, air, and space sensors and battle management platforms such as strike aircraft and ground troops.

The **Combatant Commanders Integrated Command and Control System (CCIC2S)** is a command and control system that supports the Commander, NORAD to execute the aerospace warning and control missions and supports the Commander, US Strategic Command to execute space missions through Air Force Space Command. The system also provides space situation awareness to Combatant Commanders and government agencies. Additionally, it is the command and control capability supporting the National Security Space Plan.

Enhanced Intelligence, Surveillance, and Reconnaissance Capabilities

The **Air Force-Distributed Common Ground System (AF-DCGS)** weapon system is a central component of Air Force efforts to transform the ISR infrastructure to a net-centric enterprise. The foundation of AF-DCGS is a robust space and terrestrial communications network. The terrestrial backbone is a high-speed, wide-area network that will ultimately connect at least 22 DCGS nodes around the world. The communications backbone provides added flexibility to deliver ISR data to DoD nodes to allow dispersed and distributed entities to share information, thereby generating synergy. This cross section of capabilities and expertise result in a shared knowledge base that permits AF-DCGS elements to self-synchronize as the environment changes. The result is near real-time multi-sensor tip-offs and cross-cues that facilitate dynamic retasking of sensors available to the Joint Task Force commander. The AF-DCGS concept results in a reduced forward footprint, reduced airlift requirement, and an increased level of timely support to Joint Task Force commanders. Speed of command is enhanced as AF-DCGS provides the warfighter an actionable awareness of the accelerating changes in the environment, contributing immeasurably to Information Superiority.

The Air Force is also integrating an **ISR Management** capability into the AF-DCGS and Air Operations Center weapons systems. The ISR management function enables the operators and collections managers in the AOC to visualize the status and capabilities of ISR assets in the area of operations and dynamically retask them in near real-time based on battlefield activity. The ISR Manager prototype system allows visualization of National assets, the U-2, and Predator, Global Hawk, and JSTARS navigation tracks and sensor footprints. It can also display JSTARS navigation tracks on a separate visualization tool. This visualization is then combined with a cross-intelligence database with feeds from Tactical Related Applications, Tactical Information Broadcast Service, U-2, JSTARS, Predator, and National assets. The ISR Management program will allow near real-time display of U-2, Global Hawk, and JSTARS moving target indicator tracks, Predator video, and collaboration among the program's analysts and operators at multiple geographically separated locations via Information Work Space, an on-line collaboration tool.

Another technical effort is the successful **modification of the Predator UAV's near real-time-video feed** so that the time needed to find and prosecute targets has been drastically reduced. The Rover I modification allows an AC-130 gunship to directly receive the streaming video from the Predator for targeting and situational awareness purposes. In much the same fashion, the Rover II modification allows the

UAV to transmit its video directly to forces on the ground. Both modifications allow engaged forces to rapidly identify targets, engage them, and view real-time battle-damage assessment.

In the long-term, the **Space-Based Radar** will provide the capability to look deeply and persistently into areas that are inaccessible to current platforms due to political restrictions, geographical constraints, or the technological limitations of legacy systems. The continuous global access of Space-Based Radar and the extended-loiter capability of intercontinental range UAVs such as **Global Hawk**, combined with near real-time data transfer to multiple relevant command and control elements and the **Multiplatform Radar Technology Insertion Program**, will allow constant imaging or tracking of all relevant mobile or fixed surface targets in any weather conditions in all types of terrain as well as within urban areas.

In the long-term, the **Space-Based Infrared System** will be a responsive, taskable, and steerable platform that can provide near real-time Overhead Non-Imaging Infra-Red (i.e., sensor-to-shooter connectivity) data to warfighters.

The **MC2A**, described above, also will provide important capabilities in this area.

Architectural Efforts

While the Air Force has committed to ISR integration through the establishment and funding of organizations dedicated to this goal, it is also advancing architectural improvements described below.

The Air Force is transitioning from collecting data through a myriad of independent systems (such as Rivet Joint, AWACS, JSTARS, and space-based assets) to a **Command and Control Constellation** capable of providing the Joint Force Commander with real-time, enhanced battlespace awareness. It will provide Ground Moving Target Indicator capabilities along with focused Air Moving Target Indicator capabilities for Cruise Missile Defense. Additionally, every platform will be a sensor on the integrated network. Regardless of mission function (command and control, ISR, shooters, tankers, etc), any data collected by a sensor will be passed to all network recipients. This requires networking all air, space, ground, and sea-based ISR systems, command and control nodes, and strike platforms to achieve shared battlespace awareness and a synergy to maximize the ability to achieve the JFC's desired effects.

The capabilities needed to exchange tactical information derived from multiple sensors is being addressed by multiple initiatives. They include: **Multi-Platform Common Data Link System** (for point-to-point and point-to-multi-point wideband operations) and the **Advanced Wideband Terminal** (for beyond line-of-sight operations).

The **Automated ISR** initiative will use technology to automate the TPED process to speed the delivery of finished intelligence to the user. It includes upgrades such as Distributed Common Ground System Block 10 and 20 upgrades, Network Centric Collaborative Targeting, Link 16, Automated Geo-Precise-Positioning of sensors, and Computer Aided Target Detection.

Network Centric Collaborative Targeting is an ACTD that will demonstrate a network centric operating system designed to horizontally integrate air, space, and surface ISR assets at the digital level. By providing a seamless, machine-to-machine interface, this ACTD can dramatically improve geo-location accuracy, timeliness, and combat identification of time sensitive targets. With an enhanced wideband battle management C4ISR network, it will ultimately enable a network centric, distributed processing environment by leveraging existing sensors, communications, and processing systems to dramatically reduce the time required to detect, identify, locate, and designate fleeting targets. The ACTD continues to work with the Airborne Overhead Integration Office to expand its initial capabilities. The long-range goal is to expand this capability to additional ISR sensor systems to create a greater network centric approach to find, fix, and track time-sensitive targets.

The mission of **Global Network Centric Surveillance and Targeting** (funded by the Assistant Secretary of Defense for Command, Control, Communications, and Intelligence) is to deliver a near real-time, actionable multi-sensor ISR output to the warfighter through automated upstream correlation and fusion of airborne and national data to detect, locate, and identify and prosecute previously undetected mobile time-critical targets. This program is initially focused on surface-to-air missiles and mobile theater ballistic missile launchers. The Air Force is providing operational expertise to the National Imagery and Mapping Agency, which is executive agent.

National Tactical Integration is an 8th Air Force initiative to improve information flow between national-level intelligence producers and tactical warfighters. The objective is to improve the timeliness and quantity of information available to air component staffs. Sensitive source information is stripped off and the remaining relevant tactical information is inputted into collateral level warfighter channels, making it more useable to the targeting and execution nodes in the kill chain. National Tactical Integration personnel imbedded in the AOC will understand the battle rhythm and critical information requirements by actively pulling information from national sources. This will improve the push system to a smart push-pull system.

Another Air Force effort to improve dissemination of actionable information is the **Integrated Broadcast Service.** It is a Ultra High Frequency satellite-based capability that will disseminate near real-time intelligence (threat avoidance, targeting, maneuver, force protection, target tracking, and battlefield situation awareness) to users in a given AOR and relayed to sites around the globe. The migration capability will also provide a single message format across DoD and will enable increased interoperability with Australian, British, Canadian, and New Zealand partners. The Air Force is the Executive Agent for the Integrated Broadcast Service, which is an umbrella program for the following intelligence systems: (1) the Air Force's Tactical Information Broadcast Service, (2) the Navy's Tactical Related Applications Data Dissemination System, and (3) the National Security Agency's Near Real-Time Dissemination System.

Global Broadcast System provides a true global and fully mobile communications architecture to DoD operators. Its satellite-based (Ka-band) architecture transcends previous geographic limitations to allow relatively high bandwidth transmission of mission critical information to forces virtually anywhere in the world with relative

simplicity. The Global Broadcast System was and continues to be used to support Operation Enduring Freedom in various locations throughout the CENTCOM area of responsibility. It is used extensively to transmit perishable high-bandwidth intelligence, such as UAV streaming video, and operational support data to aid combat air force and special operations personnel to fuse strategic and tactical operational views of the battlespace improving the ability to tighten the kill chain.

Another significant Air Force communications initiative is the **Extended Tether Program**. This program provides a high bandwidth, beyond line-of-sight communications relay for the U-2 and Global Hawk programs and is an integral component of the DCGS, discussed earlier. The Air Force is providing Extended Tether Program capabilities to the Global Hawk for the first time and increasing the number of simultaneous orbits flown by the Global Hawk and U-2 to four. This is a huge step towards providing persistent multi-source ISR to combatant commanders anywhere it is needed. It increases imagery, signals, and measurement and signature intelligence collection; reduces delivery time for raw data for analysis and fusion; and ultimately gets decision-quality information to the warfighters more quickly. The program will also dramatically reduce the forward footprint, which minimizes force protection concerns and reduces airlift requirements making forces lighter, leaner, and more lethal. The Extended Tether Program architecture will transition to the Transformational Communications Architecture after 2010.

The Air Force is also working on developing a communications gateway to extend and integrate the datalink architectures within the battlespace. The **capability to provide limited Link-16 information to Situational Awareness Datalink equipped platforms** for issuing commands, providing situational awareness, and reducing the risk of fratricide are the goals of this effort. The capability not only will allow aircraft with varying communications architectures to communicate with each other, but provide machine-to-machine interface and permit CAOC-to-cockpit digital command and control and extend CAOC fusion beyond line-of-site.

The **Transformational Air and Space ISR Project** is an Undersecretary of Defense (Intelligence)- and Deputy Director of Central Intelligence-chartered study to look at air and space transformational ideas for 2008-2018 timeframe. The study is on a fast track and will be completed in time to affect the FY05-09 Amended POM. The project has five working groups: CONOPS (Air Force lead), Information Needs, Scenario, Metrics, and Research and Evaluation. The plan is to create candidate force-mix architectures to evaluate against the CONOPS, information needs, metrics, and scenarios. The resulting recommendations will propose air and space trade-offs to aid executive decisions for the National Foreign Intelligence Program build.

Future ISR Integration Efforts

While some integration of ISR sensors has already taken place, there is still a long way to go. The Air Force ISR integration strategy is transitioning to align with the new Air Force CONOPS and associated CRRA process (described in Chapter VI) to define ISR integration requirements. Once these requirements are validated, the Air Force will develop and acquire new methods for ISR integration according to an ISR technology roadmap. New doctrine and/or tactics, techniques, and procedures will need to be

developed to accompany the new technology. All of these new efforts will fit within the OSD C4ISR architecture since the Air Force owns a majority of the low density-high demand ISR platforms and supports component commanders and other Services.

In addition, the Air Force will expand its efforts at integration across processed data networks through multi-discipline intelligence product networks. The capacity of communication lines and on-board processing capabilities used to distribute and process ISR data needs to be increased to handle the large bandwidth and processing demand that sensor data places on the network. Continued use of compression, pre-processing of sensor data before transmission, and fiber optics will help to alleviate this shortfall. Even if the bandwidth issues are resolved, once the data arrives, there are often multiple terminals necessary to access all relevant sources of information. The Air Force is emphasizing the need for common user interfaces that allow analysts to access multiple sources from one terminal to alleviate this problem. In addition to procuring more horizontally integrated systems, the Air Force acknowledges the need to continue wargaming and experimentation of future ISR concepts. The focus of JEFX 04 is battle management command and control, with an emphasis on air and space integration. Three focus areas will be Network Centric Infrastructure, effects-based operations, and Predictive Battlespace Awareness.

Selected Sensor-to-Shooter Linkages Prioritized by Contribution to the Joint Operations Center (JOC)

The theater **CAOCs** and the functional area managers of the AOC and E-3A will work with the Joint Operations Center (JOC) to ensure the JOC Air Operations Cell has the information it needs to prioritize required air-to-ground and air-to-air sensor-to-shooter linkages and can access these selected sensor-to-shooter links. Specifically, the CAOC Time Sensitive Targeting Teams and E-3A units can provide lessons-learned information on using sensor-to-shooter links to help the JOC Air Operations Cell to prioritize these links based on JOC requirements.

The **MC2A**, described earlier, also will provide important capabilities in this area.

Reachback Capabilities that Provide Global Information Access

A new **Airborne Networking capability** is now operational on Distinguished Visitor, Special Air Mission, and Combatant Command support aircraft. Significant capability is being provided with the operational validation of the C-32s(2), C-40Bs(2), and VC-25 aircraft equipped with integrated classified and unclassified Local Area Networks, "Connexion," and High Speed Data International Maritime/Marine Satellite air-to-ground data service. This supplements the very limited legacy capability (16K fax/data and low speed dialup). The requirement was to enable access to unclassified and classified email, shared files, and applications hosted on their home station networks as well as view-live television and participation in secure video teleconferences. The intent of the Airborne Networking capability is to provide an "office in the sky" and extend the Global Information Grid (GIG) into the airborne platforms. The Nation's most senior leadership is now enjoying this quantum leap and applying it directly to

continuity of governance and operations. The Air Force has established Air-to-GIG gateways and an Air Network Operations and Security Center to support these airlift platforms mentioned above. The next step in this effort is to expand this capability to more airborne platforms.

On 31 March 2001, an OSD memo requested that the Air Force provide a plan to implement a ground infrastructure to support modifications to the Distinguished Visitor fleet that included both primary platforms and smaller assets such as the C-37As. Therefore, Block I focused on initial support to the primary platforms. With the initial infrastructure operational, it is now necessary to focus support to the remaining Distinguished Visitor aircraft with robust global infrastructure, increase performance, and begin the support other platforms equipped with the antenna systems. This effort emphasizes three major objectives to homogenize capability across platforms, maximize performance, and ensure continuous availability to senior leadership.

The Air Force selected high-speed data International Marine/Maritime Satellite as the most viable solution to extend the GIG to smaller platforms such as C-37As. For a small investment, the Air to GIG gateways can be enhanced to support Dial access into the Non-Secure Internet Protocol Router Net and Secure Internet Protocol Router Net via Integrated Services Digital Network Remote Access Servers. In doing so, not only can distinguished visitor aircraft be support but the Air Force can also extend GIG services to other platforms such as C-17s and KC-135s that implement high-speed data International Marine/Maritime Satellite antennas. It may even be possible to provide support to the Joint Enroute Mission Planning and Rehearsal System with this small investment.

This project builds upon its prior success and applies "lessons learned" from the initial effort to take the next step in extending the GIG to all airborne platforms.

Bandwidth sharing is another key associated Air Force effort. Bandwidth sharing is a technique to provide more throughput, a higher rate return channel, and greater bandwidth efficiency. It provides an "always on" connection for network access, central server or database access, video streaming, voice services, and other multimedia services while economizing on satellite bandwidth.

Internet Protocol version 6 (IPv6) is DoD's future solution to implement a bandwidth sharing scheme and resolve contention for resources. DoD is currently using IPv4. Today's circuit-based satellite communication systems provide communications services by provisioning satellite resources to support specific user missions. Certain measures (e.g., priority, preemption, and fencing) are taken in order to guarantee such communications services. In an IPv6-based communications system, Quality of Service mechanisms can be employed to provide and guarantee equivalent communication services in order to support numerous user missions by providing bandwidth sharing. In comparison, the mechanisms employed in an IP-based environment can enhance the quality of service experienced by allowing the network to be flexible enough to dynamically react to user needs and offer better service.

The **MC2A** and **DCGS**, both described earlier, also would provide important capabilities in this area.

Adaptive Mission Planning, Rehearsal, and Joint Training Linked with C4ISR

Achieving adaptive mission planning, rehearsal, and joint training linked with C4ISR will require efforts in several key areas. First, the C4ISR architecture must continue to evolve to enable more robust network centric warfare. Second, modeling and simulation tools must continue to evolve. A synthetic, realistic environment through the Joint Synthetic Battlespace initiative will allow better integration between units—coalition, joint, and Air Force—through Distributed Mission Operations and Distributed Mission Training. Third, developing and embedding new and improved Decision Support Tools will allow commanders to leverage advantages in communications and intelligence to maintain decisive advantages over future enemies.

C4ISR Architecture

Commanders rely increasingly on surveillance to gather information on targets in real-time—and then get the information to the shooter fast enough for that asset to act. Maturing the C4ISR architecture will allow developmental teams to identify shortfalls and build a more robust and persistent ISR capability. Improving C4ISR provides National Command Authorities with greater asset capability, shorter kill cycles, and quicker battle damage assessments. The concepts of parallel warfare and EBO depend greatly on measuring opponent reactions, identifying opposing capabilities, and frustrating efforts to protect key infrastructures. C4ISR gives commanders the ability to respond quickly to opportunities to destroy critical enemy assets. The recent PGM attacks on Iraqi leadership exemplify the increased benefits associated with shortening the kill chain.

Leveraging existing capabilities creates a more persistent and robust technology. Network centric warfare gives commanders unprecedented insight into enemy actions as well as a more complete picture of assets being arrayed. For example, UAVs linked to Air Operations Centers gave commanders real-time images of potential targets and allowed them to respond to opportunities that emerged. Architecture will allow the systematic linkage of existing systems to occur, thereby increasing capabilities. Most of the programs and initiatives discussed in Chapter VII, Section A on "Information Superiority" will support this. The Command and Control Constellation Architecture is the foundation for transformation of Air Force C4ISR.

Modeling and Simulation

The increased sophistication and robustness of modeling and simulation creates the trade space for transformation to happen in a low threat, yet realistic environment. The keys for this to continue will be the development of a joint synthetic environment that allows for the Rapid Scenario Generation for various theaters of operations. Such scenario generation will allow for mission rehearsal, testing of new capabilities, and Course of Action Development in a Distributed Mission Operations environment.

Creating a **Joint Synthetic Battlespace** will allow DoD to train tailored forces to any scenario imaginable. Using Distributed Mission Operations, forces can be selected to meet national objectives, and train together in a live, virtual, and constructive forum through the entire chain of command in a realistic and meaningful way. This capability will allow commanders the ability to test strategies and tactics in a way that is not possible today.

Modeling and simulation needs to continue developing in two areas to effect transformation. First, the ability to create realistic scenarios quickly enough to allow commanders to prepare for operations anywhere in the world is critical. Current capabilities allow for desert scenarios but do not allow for sorties.

Second, the **Distributed Mission Operations** and **Distributed Mission Training** initiatives will allow commanders to train forces with a realistic mix of capabilities from the strategic level (joint battle staffs) to the tactical level (individual sorties). Through simulation, assets that are seldom available live can be incorporated into a live exercise and/or rehearsal. For example, a JSTARS simulator located at Warner Robins Air Force Base might be "connected" to a Red Flag strike package so that the JSTARS is a seamless part of the live fly operation. In other words, the same JSTARS sensor information is available to the exercise participants that would be available had the E-8 been located in an orbit supporting the Red Flag shooters. Expanding from the JSTARS-Red Flag example enables the Air Force to visualize a capability to practice missions requiring a "total team" environment where all the players and command and control are part of a realistic "virtual" battlespace where it is impossible to determine if a particular input comes from a live or virtual source.

Embedding Decision Support Tools

The next frontier of transformation is embedding decision-support tools for the commander. Selected sensor-to-shooter linkages prioritized by their contribution is a capability that is needed for the Joint Operational Commander. The ability for machine-to-machine communications to acquire targets, assign assets against opportunities, and conduct battle damage assessment will provide commanders with unimagined opportunities to shape the battlespace. The tediousness of such operations is rife with opportunities for mistakes. Freeing up manpower, like the air tasking order automation process, improves efforts and further enhances system capabilities.

Second, developing reachback capabilities allowing global information access will allow the Joint Operational Commander more rapid decision-making and better optimization of force mix. Commanders in the states can follow logistical support, munitions expenditures, medical requirements in real-time, empowering "just in time logistics" to function in global operations.

Most of the initiatives discussed both in Chapter VII, Sections A (Information Superiority) and F (Agile Combat Support) will achieve these goals.

Addressing TPG Guidance in Appendix III Regarding Interoperability Initiatives

This section addresses TPG guidance in Appendix III on pages 29-30 for Services to "explicitly identify initiatives undertaken to improve interoperability in the following areas [which comprise the sections below]..."

Deployment of a Secure, Robust, and Wideband Network

The primary Air Force effort to deploy a secure, robust, wideband network involves new **laser communications**. Laser communications offer new potential for extremely high capacity as well as secure means of communication using different frequencies and propagation means. They are inherently jam-resistant, providing much greater security. Laser communications will also transform the way data flows through the military satellite communications system by making it more network (rather than platform) centric, so data will flow more like it does on the Internet. Key associated programs that will operationalize laser communications include the **Transformational Satellite**.

In addition, **Joint Tactical Radio System (JTRS) networking** will include or support:

- Interoperability between the Services
- Seamless delivery of video, voice, and data services
- Adaptation to user message requirements or network conditions
- Ad hoc formation of scalable networks
- Automatically (waveform controlled) and manually (user controlled) adaptable radio frequency or routing features
- Standard protocols and interfaces, if possible
- Evolutionary implementation of requirements and simple insertion of new capabilities

The JTRS networking design process uses the JTRS Application Programming Interfaces and modularity features. The design includes standardized Application Program Interfaces at each layer of the waveform to provide an easy mechanism for iterative performance improvements and overall waveform evolution with advancing technology developments.

The Air Force will use JTRS networking to provide a seamless extension of the Global Information Grid to Air Force users requiring wireless network connectivity. The JTRS networking will:

- Provide high throughput, dynamically adaptable connectivity for exchange of IP-based voice, data, and video traffic.
- Support efficient and reliable interconnection between terrestrial (fixed and mobile) and airborne users of the Global Information Grid in a changing network topology without introducing gateway bottlenecks.
- Support network nodes on mobile and airborne platforms (as well as deployed and fixed platforms) without the need of intervention by the personnel on those platforms.

- Be robust and adaptable to support communications connectivity during rapidly changing distances and orientations between nodes and will support operation in the following environments: (1) co-site environments typical of command and control, ISR, and other communications-intensive airborne and ground platforms; (2) tactical radio frequency propagation environments; and (3) radio frequency spectrum utilization suitable for worldwide operation.

In addition, the JTRS networking routing capability will be robust and sufficiently flexible to support dynamically changing network topologies and radio silent subscribers. The routing capability in both ground and airborne nodes must interface to commercial routing and network planning and management processes and systems used by the Air Force (including those used with wideband satellite communications networks) that are provided externally to JTRS.

JTRS networking will also provide network services to ground (fixed, deployed, and mobile) and airborne nodes operating in a theater-size geographical area. The network will include intra-Air Force as well as joint participants. The total number of Air Force JTRS platforms in the network could range between 100 and 250 based on deployment of an Aerospace Expeditionary Force of 75 aircraft, ground support and command and control operational facilities, an on-call Aerospace Expeditionary Wing of 100 aircraft, high demand/low density aircraft, and fixed and/or deployed operational facilities. Up to 75 airborne nodes could participate in a network at any given time. The remainder of the nodes will be ground-based. Some nodes may participate in more than one JTRS WNW network simultaneously.

JTRS networking will provide network services to ground (fixed, deployed, and mobile) and airborne nodes in a theater-size geographical area of approximately 1000 by 1000 nautical miles. Minimum node-to-node line-of-site ranges that must be supported within this area of operation are as follows:

- Air-to-Air—at least 370 kilometers (200 nautical miles)
- Air-to-Ground/Surface—at least 370 km (200 nautical miles)
- Ground-to-Ground—at least 10 km (5.4 nautical miles)

JTRS networking will support theater and worldwide network connectivity by internetworking with IP-based networks on wireless and terrestrial media.

In simplest terms, **Quality of Service** is the ability of a network to differentiate between traffic types and provide differential treatment to them without adversely affecting its function or performance. In addition, the concept of networks and interconnectivity between networks through an IP infrastructure introduces the situation of "weakest link" where a single network can limit the quality of service by a) implementing poor schemes within its domain or b) implementing schemes so unique they cause poor Quality of Service translations across the network boundaries. The IP-based Quality of Service framework helps the Transformational Communications network (which includes laser communications-related systems such as the Transformational Satellite) efficiently and reliably support a variety of operational needs, e.g. emergency services, time-sensitive applications, and high priority communication channels, across a complex network.

The **DCGS**, **bandwidth sharing,** and **CCIC2S**, all described previously, also play a key role in this area.

Adoption of "Post Before Process" Intelligence and Information Concepts

The primary Air Force effort to address this subject is the **DCGS**, which is a central component of Air Force efforts to transform the ISR infrastructure to a net-centric enterprise. It was described in greater detail earlier in this appendix.

The Air Force is also integrating an **ISR Management** capability into the AF-DCGS and Air Operations Center weapons systems. The ISR management function enables the operators and collections managers in the AOC to visualize the status and capabilities of ISR assets in the area of operations and dynamically retask them in near real-time based on battlefield activity. The ISR-Manager prototype system allows visualization of National asset, U-2, Predator, Global Hawk, and JSTARS navigation tracks and sensor footprints. This visualization is then combined with a cross-intelligence database with feeds from Tactical Related Applications, Tactical Information Broadcast Service, U-2, JSTARS, Predator, and National assets. The ISR-Management program allows near real-time display of U-2, Global Hawk, and JSTARS moving target indicator tracks, Predator video, and collaboration among ISR Management analysts and operators at multiple geographically separated locations via Information Work Space, an on-line collaboration tool.

The **MC2A**, described earlier, also would provide important capabilities in this area.

Deployment of Dynamic, Distributed, Collaborative Capabilities and Achievement of Data-Level Interoperability

Most key Air Force efforts to deploy dynamic, distributed, collaborative capabilities and achieve data-level interoperability fall under one of the following categories: (1) eXtensible Markup Language implementation or (2) operational collaboration and data interoperability initiatives.

eXtensible Markup Language (XML)

The Air Force Scientific Advisory Board recommended the Joint Battlespace Infosphere concept in 1999 as an infrastructure to integrate, aggregate, and distribute information to all combat echelons. XML is a tool that will enhance machine-to-machine information exchange and help the Air Force achieve timely and accurate decision making during operations. It is the key enabling technology to create the link between content creators and content consumers to deliver the "right information to the right user at the right time in the right format" to multiple devices, including personal computers and wireless mobile devices. XML can be used to describe metadata for content and "fuselets"—a Joint Battlespace Infosphere construct for simple processing applications.

The Infostructure Architecture Council will lead an Air Force-wide implementation strategy. The Air Force is currently developing XML implementation guidelines and procedures to ensure consistency and to avoid duplication of effort across Air Force commands. The first set of implementation guidance should be complete and disseminated in late 2003.

The Air Force Departmental Publishing Office recently selected PureEdge's XML-based electronic forms product that will enable personnel worldwide to file electronic forms with electronic signatures. It is converting 18,000 forms that are used by more than 700,000 Service members worldwide.

In addition, the Air Force plays a leading role in migrating the US and NATO Message Text Formats to XML representations and has developed an Air Force XML-Message Text Format roadmap to guide future work on this and related DoD XML messaging activities.

Operational Collaboration and Data Interoperability Initiatives

The Air Force has and/or participates with the Services in a host of initiatives to improve operational collaboration and data interoperability. These include:

- The Air Force has designated the **AOC as a weapon system** to provide the Joint Force Air and Space Component Commander a standardized capability to command and control air and space forces. This action will greatly enhance horizontal integration and provide a much improved capability to support joint operations with planning, tasking, command and control, data fusion, and near real-time common operating pictures of the battlespace.
- **Link-16:** Provides jam-resistant, secure communications that can be relayed over long distances for integrated operations and supports the concept of machine-to-machine interface for horizontal integration. It is currently being installed in attack aircraft beginning with the F-15 and F-16 Blocks 40/50. The goal is to put Link-16 on all attack aircraft enabling digital interface with command and control aircraft and a variety of joint command and control ground forces.
- **Joint Tactical Radio System Migration.** The Joint Tactical Radio System, described in more detail previously in this appendix, is a joint program in which the Air Force participates. It will provide a software reprogrammable joint Services radio and data transmission system.
- **Air Force Transformation Center.** Previously, an AOC used its own unique hardware, software, and servers that were often incompatible with other systems in other Centers. The Air Force Transformation Center will ensure that the latest new technologies to achieve the capability to provide the commander a clear, coherent, real-time picture of the battlespace are incorporated into the global and theater AOCs in a timely and standardized manner.
- The **Global CONOPS Synchronization** will demonstrate ability to and benefits of sharing real-time information among Mobility Air Forces (global) and Combat Air Forces (multi-area of responsibility centric) command and control planning and execution systems, and flying assets via machine-to-machine data exchange.
- The **Multi-Platform Common Data Link** will provide point to multi-

point, network enabled, secure, wideband data dissemination operations. It is compatible with all of the Services' data links and was specifically developed to disseminate information from an airborne platform to both the Army and Air Force Distributed Common Ground Systems. This common data link will be installed onto the Global Hawk, Rivet Joint, E-10A, and ultimately in every Army Distributed Common Ground System.

Additional Air Force efforts in this area include:

- Tactical Data Link Roadmap
- Army Deep Operations Center functionality embedding into Family of Interoperable Pictures
- Leadership of Joint Expeditionary Force Experiment process
- Standing Joint Force Headquarters prototype
- Battle Management Command and Control
- SIPRNET Portal
- Airborne Networking Management
- Advanced technology communications/connectivity solutions
- MC2A
- DCGS

Deployment of "Net-Ready" Sensors, Platforms, Weapons, and Forces

The Air Force is pursuing a wide range of efforts to deploy "net-ready" sensors, platforms, weapons, and forces:

E-3A is the Air Force's preeminent airborne wide area surveillance and battle management platform providing persistent and survivable surveillance, battle management, weapons control, threat warning, and combat identification in support of commander taskings. Programs are in place to enhance machine-to-machine interfaces and decrease the kill chain timeline. The **E-3A Block 40/45 Upgrade** will integrate and fuse all E-3 sensor data (and off-board data) into a single target-single track via Multi-Sensor Integration software. Priority tracks will be quickly transmitted to shooters/decision makers with reduced data link latency via Data Link Infrastructure software, enhancing time-critical-targeting and providing net-ready sensor.

The JSTARS is the nation's premier provider of ground battlespace situational awareness—a critical capability to provide persistent ISR capability to US and allied warfighters. JSTARS' wide area surveillance operations, using ground moving target indicator, fixed target indicator, and synthetic aperture radar capabilities enables a wide variety of effects-based operations and gives theater commanders command and control and battle management of air-to-ground forces. The **JSTARS Attack Support Upgrade** digitally links JSTARS information directly into the F-15E cockpit, which increases aircrew situational awareness, efficiency, and safety. Additional information that will be provided to the F-15E includes: target sorting, attack assignments, prioritization, and weather over the target. JSTARS will be able to digitally assign a specific target resulting in a significant decrease of the timeline for time-critical-targeting. In addition,

the **Improved Data Modem** will provide critical JSTARS data to Army Apache attack helicopter gunships, which will dramatically reduce the kill chain timeline for air-to-ground targeting. The JSTARS mission crew will be able to provide moving target indicators directly into cockpits of over 500 Apaches while simultaneously providing this information to the Air Operations Center over satellite communications radio.

The **Distributed Common Ground System**, described in great detail elsewhere in this appendix, will be an open architecture, net-centric system that will enable the support of multiple, simultaneous, worldwide operations from in garrison and through scalable, modular system deployments. DCGS is also developing a common Services backbone of which other Service partners can leverage in utilizing their own TPED assets, to include AF DCGS Block 10.2

The **Roll-on Beyond Line-of-Sight Enhancement**, informally referred to as the "Smart Tanker," is the first in a family of Scalable, Modular, Airborne, Relay Terminals, which will reside on tankers, but will also be suitable for a variety of other platforms to include unmanned and ground- or sea-based vehicles. Initially, it will be a Link-16 relay that will allow line of sight-beyond line of sight communication between participants in the network. It will become a vital part of a global network to provide critical data to warfighters more quickly for faster decision-making and time-sensitive engagement of critical targets.

As the result of the Air Force Chief of Staff's Task Force for Link-16 Acceleration, the Air Force has taken several steps to improve the **Tactical Data Link Infrastructure**. These include the Interim Joint Interface Control Officer toolsets, common software, Tactical Data Link management tools, and improvements to the joint/combined Tactical Data Link Infrastructure.

The Air Force has also taken numerous initiatives to improve interoperability in deploying "net-ready" UAV and ISR assets:

- The Air Force participates in the DoD UAV Interoperability Working Group to pursue joint-Service and international cooperation in UAV programs to support system development. Its goal is to implement a standards-based approach for UAVs, including combat support and combat applications, to satisfy joint interoperability requirements and allow rapid integration into combat operations.
- A Joint Program Office is being stood up on 1 October 2003 to address Air Force and Navy UCAV issues. Its goal is to create standards that will allow UCAVs to be built along common lines in hopes of decreasing costs while retaining interoperability.
- All production version Global Hawk air vehicles and existing U-2s will be able to relay sensor data via the High Altitude Endurance ISR Beyond Line of Sight communications architecture. This will allow adequate bandwidth to download ISR images from more than a single Global Hawk at a time.
- Global Hawk UAV can downlink imagery directly to the US Army Tactical Exploitation System for exploitation by the US Army. This shows improved interoperability of "net-ready" sensors and platforms to meet Warfighter requirements.

- The Air Force is developing air and ground terminals in the Family of Airborne Terminals program that will allow both the Global Hawk UAV and U-2 systems to be interoperable with the Wideband Gapfiller System Ka-band satellite communications constellation. These terminals will allow these systems to retain backward compatibility with current beyond line-of-sight communications options.
- The UCAV program is about to begin a compatibility study for operations with the next generation of Extremely High Frequency Milstar satellite communications and the Advanced Extremely High Frequency system.
- Global Hawk is adding a Signals Intelligence capability to its current Imagery Intelligence payload.
- UCAV is being designed to be more net-centric with up to four air vehicles being controlled simultaneously by a single ground station. Currently it requires one ground station to control a single UAV.
- Global Hawk will possess an Ultra High Frequency military satellite communications data interoperability capability in 2004, with voice interoperability being added in 2007.
- The Air Force is upgrading U-2 data capabilities from the current serial data transfer mode to Asynchronous Transfer Mode, which will improve interoperability of sensor data transfer.
- The Air Force is installing Link-16 on U-2s and in DCGS, which will improve interoperability with the airborne datalink command and control network.
- Global Hawk UAV and the U-2 are currently reviewing options and planning to migrate to the JTRS, which will improve interoperability with the airborne network.
- Predator UAV has just completed a major initiative that improved interoperability and "net-ready" operations by implementing a robust, CONUS-based, reachback architecture. The Predator Operations Center is fully operational and is the central Predator UAVs control facility that takes maximum advantage of access to CONUS communications and classified intelligence networks. This has resulted in having to forward deploy only the air vehicles and the launch and recovery station, which has greatly reduced the amount of communications network infrastructure that is required at the forward operating location.
- Predator UAV is implementing the Triple Digital Encryption Standard, which will increase net-centric security. The Air Force desires to migrate Predator UAV to a National Security Agency approved encryption algorithm to further enhance network security and take advantage of encryption standards used throughout the networks. Remote split operations also reduced the personnel tempo, the force protection footprint, airlift requirements, and deployment timing while providing networking operational synergy.
- Predator UAV is implementing a secure voice capability that will allow enhanced interoperability with airborne voice networks.
- Predator UAV has moved away from specialized point-to-point video dissemination circuits and now uses the Global Broadcast System network as the primary Predator UAV video dissemination path back to the warfighter.
- Predator UAV is implementing a Tactical Common Data Link solution to replace the current analog C-band line-of-sight communications architecture. This will migrate Predator UAV to Common Data Link, which is the DoD standard for unprocessed imagery data. (Global Hawk and the U-2 currently employ Common Data Link).

- The Tactical UAV Initiative, which will embed a small tactical UAV squadron within Air Force Special Operations Command, includes the seamless integration of smaller unmanned systems with the established mainline systems the Air Force currently employs.

In the near-term, the Air Force is pursuing a number of initiatives to improve the kill chain timeline by linking the sensor and shooter and linking the shooter into a network of information. This includes accelerating installation of **Situational Awareness Data Link Gateway** and Near-Term Enhancements to the Tactical Data Link Architecture. These combine to allow greater numbers of combat aircraft to access the Tactical Data Link Architecture and give access to a wider variety of Air Force and Navy platforms from Active, Guard, and Reserve components. The Air Force has also installed **Digital Imagery Request and Distribution System** at a number of locations to give friendly forces national and theater imagery faster. In the long-term, programs such as **Space-Based Radar** will provide unprecedented persistence and send critical target location information to a network of users worldwide to find, fix, track, target, engage, and assess targets anywhere on the globe and send that targeting information to the right network of shooters at the right time.

Associated Advanced Concept Technology Demonstrations

Adaptive Joint C4ISR Node: This ACTD will integrate, demonstrate, and transition a single, multi-mission, morphable radio frequency system that provides seamless interoperable communications, signals intelligence, electronic, and information capabilities. It will be demonstrated in an aircraft for the ACTD, but can be employed in a variety of platforms—manned and unmanned air, sea or land in a theater-wide networked constellation providing ubiquitous multi-mission support of radio frequency operations. This ACTD will enable interoperability among the Services and coalition partners, reduce reliance on high demand/low density assets (e.g., Rivet Joint), improve timeliness in responding to emerging requirements and threats and disseminating intelligence collection, increase fidelity in battlespace picture and broad situational awareness, significantly increase access for conducting network warfare operations, and reduce the logistics burden through common hardware.

Agile Transportation (AT21): This ACTD will demonstrate total visibility of all transportation requirements, available lift assets, personnel, and equipment moving to and within the various theaters of operation. Advanced scheduling decision-support tools will be used for mode determination and optimization of strategic lift assets resulting in reduced force closure times, smaller theater logistics footprint, and approximately $40 million annual cost avoidance. US Transportation Command is the operational sponsor.

Joint Tactical Radio System Networking Requirements and Capabilities in Relationship to the GIG

To achieve the specific and derived requirements of Joint Vision 2020 and the Global Information Grid CAPSTONE Requirements Document requires a single interconnected, end-to-end information transport network. The Joint Tactical Radio System, as the OSD designated network enabler of the deployed operational area, provides the GIG transport for the deployed force commander. It will provide a seamless, highly flexible, and adaptive communications capability, offering the means for total horizontal and vertical C4 systems interoperability, for all radio sets and networks at all echelons for the 21st Century warfighter, to ensure full spectrum dominance in peacetime and in war.

While a JTRS radio or JTRS Network node may not serve every user across the deployed area, the JTRS Network will service every mobile user and the majority of large stationary users. All nodes connected to the deployed area will be JTRS Network compatible/compliant, including those of existing or planned deployed static wide area networks and supporting networks such as Transformational Communications.

The JTRS has primary responsibility for providing the deployed portion of the GIG's information transport and network operations functions, along with other supporting systems.

The JTRS network is a collection of JTRS-enabled user nodes. When connected, these nodes will create an information mesh across the battle space. Each node, whether moving (orbiting satellite, aircraft, surface ship, submarine or vehicle) or static (geosynchronous satellite, fixed or stationary command post, fixed sea or land sensor) will provide a portion of the network. Each node not only provides for its own information needs, but as a part of the network, provides transit and other support for the overall network. The sum of the nodes will create the network. The nodes will establish and use discrete connections with one another to disseminate information. Connections may not be direct, but may be virtual through other nodes. The key to this adaptable network connectivity will be nodal network awareness. Each node in the network constantly will query its surrounding nodes for changes of network status and will conduct self-queries to establish internal status and provide information for its surrounding nodes. This will provide the network information necessary to maximize the information transport capabilities given the resources allocated to each node and the network.

Addressing Information Superiority Guidance in TPG Appendix III:

Page 30 of the TPG requires that Service transformation roadmaps "address plans to implement...information superiority, the identification and employment of all its elements, how it should be represented in war plans and joint experimentation, and how to achieve it." Much of this is directly addressed in Chapter VII, Section A ("Information Superiority") and in earlier sections of this Appendix addressing interoperability and intelligence. This section addresses the remaining key aspect of information superiority: information operations. As described in Chapter VII, information superiority can provide a revolutionary advantage for US forces only by ensuring that the adversary: (1) cannot disrupt, manipulate, or destroy the associated friendly information, information systems, and information processes on which they rely and (2) does not have effective C4ISR of its own.

Achieving the first requires effective information operations that ensure friendly use of the information domain. In fact, as the world's most information-dependent fighting force, the US military, must use the IO capabilities of network defense, information assurance, operations security, military deception, counterintelligence, and counter-propaganda to degrade, disrupt, deny and destroy the ability of adversaries to exploit this reliance on information and assure jam-resistant, secure, survivable C4ISR. By integrating these IO capabilities to protect or project the commander's objectives and themes, military operations have a much greater chance at success.

Against adversaries with effective C4ISR, achieving the second requires information operations capabilities that can effectively degrade, disrupt, deny, and destroy an adversary's C4ISR capability. These include network attack, electronic warfare, military deception, public affairs operations, Operations Security, and PSYOP.

The Air Force is leading efforts to present many more of these classified IO capabilities to the Combatant Commanders either as apportioned capabilities or by making Combatant Commanders aware of limited combat capabilities presented by development programs. Most programs are very small in nature and would collectively be too numerous to list comprehensively here. Determining even unclassified funding for IO is extremely difficult at the present time as most funds are embedded in larger Program Elements that contain non-IO funding or, in the case of information assurance, is built into new C4ISR systems. The Air Force, however, is in the process of attempting to determine actual IO funding levels.

The Air Force is currently redefining its Information Operations mission area. It has initiated a two step process that will align it better with OSD and Joint Staff terminology and better define its components. First, the Air Force is in step with the OSD and Joint Staff efforts to refocus IO into five core capabilities: electronic warfare, network warfare operations, operational security, MD, and psychological operations. This will essentially refine a mission area that has been too broadly defined in past doctrine and was difficult to operationalize. In addition, the Air Force will move away from the information warfare (IW) and information-in-warfare construct and move to a doctrinal framework that defines information warfare as theory and IO as the

application of that theory. Second, the Air Force has taken the five core IO capabilities and applied them to the operational level of war. This has resulted in the following Air Force understanding of the joint IO definition: *"Information operations is the integrated planning, employment, and assessment of Influence Operations, Electronic Warfare Operations, and Network Warfare Operations capabilities, in concert with specified integrated control enablers, to influence, disrupt, corrupt, or usurp adversarial human and automated decision making while protecting our own."* Influence Operations, Electronic Warfare Operations, and Network Warfare Operations are the "operational-level functions" associated with IO. The IO Mission Area Plan will reflect this structure, and ultimately Program Elements will reorganize to give greater insight into the programming and budgeting for IO. These doctrinal refinements should leave the Air Force better poised to seamlessly integrate into the joint community.

The Air Force's current focus in IO via the effects-based IO Mission Area Plan reflects a mix of materiel and non-materiel solutions: These efforts include:

- **Information Warfare Flights:** The Air Force trains, equips, and fields units to provide IO combat power to the Combat Air Forces, Mobility Air Forces, Special Operations Forces, the space community and combatant commanders. The Flights provide integrated IO planning capabilities to air and space operations at the operational and tactical levels for planning and execution monitoring, including IO support for AEFs. Each Flight includes experts in network attack/defense, operational security, military deception, PSYOP, electronic warfare, information assurance, counter-intelligence, and intelligence, who are trained to synchronize the planning and execution of IO actions in support of the Joint Force Air Component Commander, Joint Force Commander, and/or functional AOC (e.g., Tanker Airlift Control Center) commander. While Information Warfare Flights have existed for several years now, the Air Force is currently in the process of evaluating the force and command and control structure for these Flights to provide better support to the warfighter and incorporate Operation Enduring Freedom and Operation Iraqi Freedom lessons learned. It is also working to better integrate the Flights into the Air Operations Center planning by exploring a better chain of command than currently exists. For example, the Electronic Warfare Coordination Cell made significant contributions as a formally organized entity operating on the AOC staff during OIF. The Air Force is taking steps to ensure this functional capability, representing a traditional stand-alone function, exists in all future operations and is able to contribute meaningfully to the Information Warfare Flights in whatever form it takes in the future.
- **Information Warfare Planning Capability:** This capability is currently being developed as an integrated set of information warfare campaign planning and execution applications to support analytical collaboration, data fusion, event sequencing, and synchronization, targeting, situational awareness and information domain visualization to support IO course of action development in the AOC. In the future, the IW Planning Capability will need to address the specific needs of the Air Force IO defined operational functions (Electronic Warfare Operations, Network Warfare Operations, and Influence Operations) to ensure functional needs are met. In December 2002, OSD recommended that the IW Planning Capability suite of tools be adopted as the joint standard for IO planning.

- **Integrated Information Operations Training:** In the future, the key to achieving information superiority is to integrate the planning and execution of information operations and to develop and foster a robust, trained, and experienced IO workforce. The Air Force has established the only DoD school for advanced hands-on IO training. It provides experienced communications, intelligence, counterintelligence, space, information assurance, public affairs, and PSYOP personnel with specialized technical training in IO and IO support. In addition, the Air Force will develop standard procedures and techniques to more fully plan, integrate, employ, and assess the operational functions of IO. The Air Force is working to more closely align this training with AOC weapons system crew training. It is also working to make it available to a wider Air Force audience and to the joint warfighter community through expanded classroom education and training, mobile training teams, distance learning, virtual exercises and experimentation, increased red teaming, etc.
- **Influence Operations Capabilities:** IO uses multiple influence capabilities to shape the cognitive battlespace prior to and during crisis/conflict and return to peace. The objective of influence operations is to promote synergy with the full range of air and space operations and to ensure Air Force influence capabilities are synchronized, interoperable, and integrated to increase overall joint influence capabilities and avoid redundancy. In peacetime, influence operations communicate the objective of American, allied, and coalition forces and exhibit the overwhelming power inherent in air and space forces with the objective of achieving a decisive outcome, negating the requirement for more traditional military operations, thereby reducing friendly casualties and lowering operating costs. The Air Force is working to develop, produce, distribute, and disseminate influence operations messages across the technological spectrum—sophisticated to primitive—and maintain the ability to operate successfully in "no tech/low tech" while developing techniques to operate successfully in high tech areas of the world to include denied and permissive areas.
- **Counterintelligence Support to Network Operations and Security Centers:** Counterintelligence expertise is needed to recognize threats and mitigate the vulnerabilities of US and allied information and information systems. Critical nodes must be monitored and protected by regional counterintelligence experts to catch and prevent intrusions and ensure the integrity of Air Force information systems. Increased emphasis on the human intelligence aspect of counterintelligence must be rejuvenated within the Air Force to effect understanding of the vulnerabilities associated with the re-defined threat to the Air Force global mission.
- **Enhanced Air Force PSYOP:** PSYOP is an important perception management tool throughout the spectrum of conflict. Psychological preparation of the battlespace permits identification of psychological vulnerabilities, effects-based targeting, and PSYOP measures of merit. Automated tools, increased emphasis on analytical techniques and tools, and improved delivery mechanisms will significantly enhance the effectiveness of Air Force and DoD PSYOP capabilities.
- **Information Superiority Range:** The Air Force is currently working to develop full-spectrum research, development, test, engineering, and experimentation range infrastructure to support IO that is integrated with existing ranges used for RED FLAG and other force-on-force exercises and training. Such a range is needed to support transformational changes in the technological environment. It must

leverage existing combat training ranges and encompass policies and programs in all mediums of warfare to allow total integration of sensor-to-shooter activities vice mere de-confliction in time. This is the only way to ensure successful development of multi-platform weapons and create an environment for commanders to practice the integration of all ground, maritime, air, space, and information capabilities.

- **IO Normalization:** The Air Force has several initiatives completed and in progress to operationalize and normalize IO for effective force presentation and warfighting planning/execution. Among them:
  - Policy: Several Air Force policy documents have been published to guide IO development and operation. This includes drafting a new Air Force Policy Directive 10-7 to tie together IO policy guidance previously split between several documents into a single IO policy document. The Air Force has identified Air Combat Command as the lead command to oversee and guide Air Force IO capability. ACC is creating an overall IO CONOPS to describe the integration of IO and formalize the conduct of IO throughout the Air Force. It will provide clear guidance on cross-functional IO support to the Joint Force Air Component Commander, Joint Force Commander, or functional AOC Commander.
  - Career Force and Progression: To ensure field commanders have trained, experienced, mission-ready personnel, the Air Force is determining the feasibility of a stand-alone IO career field, with a desired skill set for an IO career force and guidelines for career progression. Headquarters Air Force, in coordination with Air Combat Command, 8th Air Force, and the Air Intelligence Agency has established technical training curricula, fundamental career progression guidelines, and classification tools to build and track IO warriors. This is essential to develop a trained, experienced IO career force, and is being integrated with broader OSD efforts as they begin to develop a Joint IO career force.

  The Air Force will also take steps to capture lessons learned from recent operations and define and develop relations and objectives toward which the IO team will achieve.

- **Electronic Warfare Revitalization:** Several initiatives focus on improving Air Force electronic warfare capabilities. There is now a single office responsible for all electronic warfare matters across the Air Force (AF/XORE), bringing together previously scattered duties and responsibilities. In summer 2000, a 4-star Air Force summit reviewed and reaffirmed the importance of Air Force electronic warfare programs. Action items to address people, equipment, intelligence, ranges and exercises, metrics, organization, future roadmaps, and doctrine issues are in progress.

  In addition, the Air Force was fully engaged in the **Airborne Electronic Attack Analysis of Alternatives** study, and it conducted an Electronic Warfare Long Range Assessment to ensure appropriate electronic warfare capabilities are available to meet a full-range of future military requirements. Using this study as the catalyst, the Air Force is addressing the joint need for airborne electronic attack as part of a broader context. The concept for airborne electronic attack is a network of

systems capability adequate to sustain the AEF and joint air, ground, sea, and space operations across the spectrum of conflict in 2010 environment. Along with the Navy's EA-6B ICAP III and EA-18G, the Joint Network of Systems will include B-52s with electronic attack pods, UCAVs with electronic attack capabilities, Active Electronically Scanned Array with electronic attack capability in the F/A-22 and F-35, miniature air launched decoy jammer, and Compass Call. The joint solution to this problem is a balanced approach based on capabilities and not platforms and a network of systems rather than a stand-alone program.

- **Air Force IO School:** The Air Intelligence Agency's 39th Information Operations Squadron runs the IO Integration Course to train Air Force information warriors in the latest information gain, exploit, attack, and defend methodologies. Graduates from the IO Integration Course are assigned to IO integration positions worldwide, providing IO products and services to field combatant commanders.
- **Air Force Network Operations and Security Center:** Currently the Air Force Computer Emergency Response Team defends Service networks, and the Air Force Network Operations Center enables information flow. Base network control centers reporting to the major command network operations and security centers are the gatekeepers for information flow within the MAJCOM. The Air Force Network Operations and Security Center will unite these nine MAJCOM Network Operations and Security Centers, as well as other communications agencies, to provide a single command and control authority. This will completely change the way the Air Force handles the command and control of network warfare operations. It will enable the Air Force to maintain its information superiority by giving the Air Force one organization to handle both Service-specific and joint computer responsibilities.

Appendix C:
HOW THE AIR FORCE SUPPORTS THE QDR'S "CRITICAL OPERATIONAL GOALS OF TRANSFORMATION"

"Our job is to close off as many…avenues of attack as possible. We must prepare for new forms of terrorism, to be sure, but also for attacks on U.S. space assets, cyber-attacks on our information networks, cruise missiles, ballistic missiles, and nuclear, chemical, and biological weapons. At the same time, the United States must work to build up its own areas of advantage, such as our ability to project military power over long distances, our precision strike weapons, and our space, intelligence, and undersea warfare capabilities."

–The Honorable Donald Rumsfeld, Secretary of Defense

The Transformation Planning Guidance states that this and future roadmaps "will address capabilities and associated metrics to address the six transformational goals [the "QDR-6"] and the joint operating concepts." This chapter describes how the Air Force's ongoing transformation strongly supports the six "critical operational goals of transformation" articulated in the 2001 QDR.

For each QDR transformation goal, this appendix begins by quoting the portions of the QDR in italics describing the goal. It then briefly summarizes how the Air Force transformation efforts discussed in the Flight Plan are addressing those goals. To avoid repeating information, it makes references to relevant details discussed in other parts of the Flight Plan. In those cases in which there are key relevant Air Force efforts not already discussed in the Flight Plan, this chapter describes them in more detail. This information is charted at the end of the appendix. The chart lists all of the Air Force programs, future system concepts, organizational changes, and other efforts discussed in the Flight Plan and signifies which of the QDR goals each supports.

Please refer to Chapter VI for more details on specific CONOPS.

It is important to emphasize that this appendix focuses on identifying key ongoing and future Air Force procurement and R&D efforts discussed in the Flight Plan that address the QDR's critical operational goals of transformation. **There are numerous Air Force legacy systems and capabilities not discussed that are also critical enablers of these broad objectives.** An initial assessment in late 2001 revealed that nearly 80 percent of all Air Force programs and funding support the QDR's six operational goals of transformation in some way. However, including them all here did not appear to be consistent with guidance from the Office of Force Transformation not to rehash legacy programs in the Flight Plan and, instead, focus on future efforts.

A. Protect bases of operation at home and abroad and defeat the threat of CBRNE weapons

Protecting the American homeland from attack is the foremost responsibility of the U.S. Armed Forces and a primary mission for the Reserve Components. Future adversaries will have a range of new means with which to threaten the United States. It is possible to identify some of these means, including new techniques of terror; ballistic and cruise missiles; weapons of mass destruction, including advanced biological weapons; and weapons of mass disruption, such as information warfare attacks on critical information infrastructure. Others, like those used to attack the United States on September 11, 2001, may be a surprise. Defenses against known and emerging threats must be developed. New approaches to achieving early warning of new threats are a high priority. [Page 30 of QDR]

The continued proliferation of ballistic and cruise missiles poses a threat to U.S. territory, to U.S. forces abroad, at sea, and in space, and to U.S. allies and friends. To counter this threat, the United States is developing missile defenses as a matter of priority. Integrating missile defenses with other defensive as well as offensive means will safeguard the Nation's freedom of action, enhance deterrence by denial, and mitigate the effects of attack if deterrence fails. The ability to provide missile defenses in anti-access and area-denial environments will be essential to assure friends and allies, protect critical areas of access, and defeat adversaries. DoD must be prepared to provide near-term capabilities to defend against rapidly emerging threats and more robust capabilities that evolve over time.

DoD has refocused and revitalized the missile defense program, shifting from a single-site "national" missile defense approach to a broad-based research, development, and testing effort aimed at deployment of layered missile defenses. These changes in the missile defense program will permit the exploration of many previously untested technologies and approaches that will produce defenses able to intercept missiles of various ranges and in various phases of flight. These defenses will help protect U.S. forward-deployed forces. Moreover, they will provide limited defense against missile threats not only for the American people, but also for U.S. friends and allies. [Page 42 of QDR]

Efforts to defeat the CBRNE threat are focused on protecting US and friendly forces and civilian personnel while maximizing operational capabilities, including sortie generation, in CBRNE threat environments. Managing the CBRNE threat must be accomplished with a layered offensive and defensive capability. Success in deterring a potential adversary from acquiring or developing CBRNE capabilities will reduce the requirements for counterforce and active and passive defensive capabilities. If the adversary CBRNE capability is severely degraded or destroyed through effective counterforce targeting and strike operations, then the burden placed on missile and ground defense elements is reduced. If missile and ground defense elements are able to deny, divert, or destroy inbound CBRNE attacks, there is less of a burden on nuclear, biological, and chemical passive defense assets, thereby making it easier for forces to sustain operations in contaminated environments. If CBRNE attacks reach the fixed operating sites, forces must be organized, trained, and equipped to continue mission-critical operations in a complex, but manageable, environment. These elements of offensive strikes,

active missile and ground defense, and Counter-CBRN passive defense operations must work in concert to ensure that the Air Force is prepared to operate against adversaries armed with CBRNE.

Key programs that will enable next-generation missile defense capabilities include: Space-Based Infrared System–High, which will track missile launches, as well as the Airborne Laser to intercept and destroy missiles over enemy territory. More long term, the Air Force is exploring concepts of deploying a "postulated space-based laser system dubbed Evolutionary Air and Space Global Laser Engagement System, which could provide global 24-hour coverage of enemy missile launch sites. In addition, the Air Force is developing Agent Defeat weapon systems designed to improve target lethality over current inventoried systems and mitigate the negative collateral effects of a direct strike against chemical or biological agents. In the long run, it is also looking to develop rapid global attack capabilities such as the Common Aero Vehicle to rapidly destroy critical targets, such as CBRNE-related targets, at the onset of conflict.

In the area of cruise missile defense, the MC2A, equipped with the Multi-Platform Radar Technology Insertion Program sensor, will greatly enhance the Air Force's ability to detect, track, and identify cruise missiles. The F/A-22's highly capable radar and supercruise capabilities will enable the aircraft to track, rapidly close in, and engage enemy cruise missiles.

The Air Force is also developing and exploring various programs and future system concepts that are vital in counter-CBRNE operations: the Advanced Standoff Cruise Missile, Advanced Tactical Laser ACTD, Cooperative Persistent Surveillance Strike Vehicle, CV-22, Low-Cost Persistent Area Dominance Miniature Missile, M-X Low Observable Advanced AF SOF Air Mobility Platform, and the Robust Autonomous Attack Missile.

In cooperation with the Joint Program Executive Office-Nuclear Biological and Chemical Defense, the Air Force is leading development of, or participating in the development and fielding of, many passive defense capabilities. The Full Spectrum Threat Response Program will provide the cornerstone of the Air Force effort in the CONUS Weapons of Mass Destruction emergency preparedness and response and Nuclear, Biological, and Chemical Defense outside the continental United States. Key programs that support current and future capability include: the Air Force Weapons of Mass Destruction Integrated LOGCAT/GeoReach-Expeditionary Site Planning/Mapping, Emergency Response Program, Biofeedback System, Biomarker System, Joint GUARDIAN Program, Joint Biological Agent Identification and Diagnostic System, Joint Biological Point Detection System, Joint Chemical Agent Detector, Joint Chemical-Biological Agent Water Monitor, Joint Container Refill System, Joint Modular Chemical-Biological Detection System, Joint Service Family of Decon Systems, Joint Service Installation Pilot Project, Joint Service Light Nuclear, Biological, and Chemical Recon System, Joint Service Lightweight Standoff Chemical Agent Detector, Joint Service Sensitive Equipment Decon System, Joint Transportable Collective Protection System, Joint Warning and Reporting System, and the Restoration of Operations ACTD.

The Air Force is also participating with the Defense Threat Reduction Agency and other Services in Science and Technology efforts to investigate new technologies for transition into equipment developments that will keep the Air Force well ahead of any future potential adversaries contemplating the use of CBRNE weapons.

The Air Force is also expanding its anti-terrorism and force protection efforts. It has developed a Force Protection and an Integrated Base Defense CONOPS to compliment the Air Force CONOPS and implement transformational technologies as well as Tactics, Techniques and Procedures that address the new asymmetric threat to bases in both CONUS and abroad. The Force Protection Battlelab and other Air Force Battlelabs have expanded their foci to identify innovative concepts to combat terrorism and have instituted programs to address physical security, explosive detection and blast mitigation, and chemical and biological detection. The latter programs follow DoD-established standards for decontamination and containment operations to enable continuity of operations in nuclear, biological, and chemical environments. In cooperation with its DoD partners, including the Joint Program Office for Biological Defense, the Force Protection Battlelab is experimenting with the next generation package of test equipment and logistics concepts designed to compress the time required to detect the presence of chemical or biological agents from hours to a few minutes to significantly enhance the protection afforded troops in areas susceptible to attack.

Drawing upon lessons learned from past events, the CONOPS for Integrated Base Defense and Force Protection defines a role for every Airman as a force protector and a sensor. Besides these changes to training, tactics, techniques, and procedures, the Air Force is also developing a wide range of offensive and defensive capabilities in the Integrated Base Defense Security Systems. These include new sensors, command and control systems for a common operating system, and a suite of remotely operated sensors, weapons, and robotics. Also included are a group of non-lethal weapon systems like the Active Denial System ACTD, which will enable a revolutionary new set of capabilities for the commanders.

The Homeland Security CONOPS will integrate Air Force capabilities into joint and interagency efforts to effectively prevent, protect against, and respond to a variety of threats to the homeland. The AEF support elements will have organic force protection capabilities and be capable of defending against conventional air attack and surveillance, deploying robust theater missile defenses, protecting bases against unconventional threats to equipment and personnel, maintaining adequate force protection in high threat environments, and mitigating damage for attacks that get through. With air refueling support, the Global Strike and Global Response CONOPS will provide the preemptive capability to defeat the threat of CBRNE weapons at their source, thereby allowing the Global Mobility CONOPS to rapidly deploy follow-on combat forces to sustain combat operations.

The Air Force also recently stood up the Directorate of Homeland Security to develop and implement the Air Force's HLS strategy, lead HLS efforts at the headquarters, and coordinate HLS efforts between the headquarters and the Air Force MAJCOMs. The Directorate's ultimate goal is to incorporate homeland security into every aspect of

Air Force policy, procedure, and doctrine. The Air Force, as directed by the *Air Force Strategic Planning Directive for Fiscal Years 2006-2023,* will identify specific required Air Force capabilities to support the National Strategy for HLS objectives of preventing terrorist attacks within the United States, reducing vulnerability to terrorism, and minimizing the damage and recovering from attacks on the United States that do occur.

Predictive Battlespace Awareness capabilities, especially those associated with persistent ISR, will also contribute significantly to this QDR goal. Key efforts include Space-Based Radar and various UAVs.

B. Assure information systems in the face of attack and conduct effective information operations

The increasing dependence of societies and military forces on advanced information networks creates new vulnerabilities and opportunities. Potential adversaries could exploit these vulnerabilities through means such as computer network attack and directed energy weapons. The emergence of these new tools of warfare also provides opportunities for non-kinetic attack by U.S. forces. [Page 31 of QDR]

Information operations provide the means to rapidly collect, process, disseminate, and protect information while denying these capabilities to adversaries. Such operations provide the capability to influence perceptions, perform computer network defense and attack missions, conduct electronic warfare, and carry out other protective actions. Information operations represent a critical capability enhancement for transformed U.S. forces.

The QDR highlights both the imperatives for the United States to maintain an unsurpassed capability to conduct information operations, as well as the need to strengthen U.S. capabilities in these areas. DoD must also develop an integrated approach to developing information system requirements, acquiring systems, and programming for the force of tomorrow. The ability to conduct information operations has become a core competency for the Department. [Page 43 of QDR]

The Air Force is developing a wide range of IO capabilities to be employed across the spectrum of conflict and in every phase of a campaign. These capabilities will be planned, presented and executed within responsive but normalized organizational constructs that support Joint Force Air Component Commander and Joint Force Commander objectives. Many details of these capabilities and programs are classified and too numerous to list. The Global Strike, Global Response, and Global Mobility CONOPS underscore the requirements for IO; the Homeland Security CONOPS includes the requirements to protect "critical infrastructure," which includes information systems; and the Space&C4ISR CONOPS describes a full-range of critical IO activities. The Air Force has made significant progress in formalizing IO doctrine and policy and integrating IO into operational air and space missions. Specific efforts include: The reorganization of the Eighth Air Force to incorporate the IO capabilities, the formation of Information Warfare Flights, the Electronic Warfare Coordination Cell, the development of an IO planning tool called IW Planning Capability, Integrated IO Training, Counterintelligence Support to Network Operations and Security Centers,

enhanced Air Force PSYOP and Influence Operations, an Information Superiority Range, IO CONOPS, IO Career Progression, electronic warfare revitalization, IO Integration, and the Air Force IO School. In addition, the Air Force Network Operations and Security Center will unite the nine MAJCOM Network Operations and Security Centers as well as other communications agencies to provide a single command and control authority to significantly improve network defense. Please see Appendix B for details.

C. Project and sustain US forces in distant anti-access and area-denial environments

Future adversaries could have the means to render ineffective much of our current ability to project military power overseas. Saturation attacks with ballistic and cruise missiles could deny or delay U.S. military access to overseas bases, airfields, and ports. Advanced air defense systems could deny access to hostile airspace to all but low-observable aircraft. Military and commercial space capabilities, over-the-horizon radars, and low-observable unmanned aerial vehicles could give potential adversaries the means to conduct wide-area surveillance and track and target American forces and assets. New approaches for projecting power must be developed to meet these threats. [Page 31 of QDR]

The defense strategy rests on the assumption that U.S. forces have the ability to project power worldwide. The United States must retain the capability to send well armed and logistically supported forces to critical points around the globe, even in the face of enemy opposition, or to locations where the support infrastructure is lacking or has collapsed. For U.S. forces to gain the advantage in such situations, they must have the ability to arrive quickly at non-traditional points of debarkation to mass fire against an alerted enemy and to mask their own movements to deceive the enemy and bypass its defenses. Consequently, DoD must carefully monitor attempts by adversaries to develop capabilities that could detect and attack U.S. forces as they approach conflict areas or hold at risk critical ports and airbases with missiles and CBRNE attacks.

The QDR emphasizes the need for new investments that would enable U.S. forces to defeat anti-access and area-denial threats and to operate effectively in critical areas. Such investments will include: addressing the growing threat posed by submarines, air defense systems, cruise missiles, and mines; accelerating development of the Army Objective Force; enhancing power projection and forcible entry capabilities; defeating long-range means of detection; enabling long-range attack capabilities; enhancing protection measures for inter-theater transport aircraft; and ensuring U.S. forces can sustain operations under chemical or biological attack. [Pages 43-44 of QDR]

The Air Force is developing numerous transformational capabilities to address the many capabilities encompassed by this objective. According to the QDR guidance outlined above, this goal can be subdivided into the following categories, which are followed by a short summary of relevant Air Force efforts:

- **Rapid Deployment:** The "way ahead" to achieve improved rapid global mobility is contained in the Air Mobility Master Plan 2004. Technological improvements, such as enhanced defensive systems, will allow operations in hostile threat environments. Autonomous approach and landing equipment will enable operations to be

conducted regardless of weather conditions and independent of ground-based navigation aids. Automated air refueling technologies will permit the refueling of manned as well as unmanned air vehicles on fueling tracks obscured by clouds. Mobility, strike, and ISR operations would not be degraded by weather in the refueling areas. Interoperable Mobility/Combat Air Force command and control systems will enhance global mobility operations. In the future, a family of transport category aircraft will significantly improve mobility support to the warfighter. They will be capable of transporting the Future Combat System, regardless of weather conditions, over intercontinental ranges to unimproved landing areas in a threat environment. Variants, with common engines, airframes, and cockpits, could be built to fly a variety of airlift, special operations, ISR, and refueling missions. The next generation advanced tanker will have a reduced signature and improved defensive systems to permit refueling closer to the target area, thus extending strike aircraft ranges or time on station. The Rapid Global Mobility section of Chapter VII contains further details.

- **Monitoring adversary anti-access capability development:** This will require a wide range of improved persistent ISR capabilities across the board. The Space-Based Radar and UAVs will be critical to this goal with their ability to penetrate deep into adversary territory. The Information Superiority section of Chapter VII contains more details.
- **Defeating air defense systems:** This is addressed squarely in the Negating Enemy Air Defenses section of Chapter VII. Stealthy platforms such as the F/A-22 can penetrate air defense systems without being seen. Unmanned combat air vehicles can be used against high-risk, high-value air defense system targets. Standoff capabilities such as the Joint Air to Surface Standoff Missile-Extended Range will enable the United States to strike critical targets without being subject to their air defenses. The Air Force is also exploring future system concepts in standoff weapons such as Advanced Standoff Cruise Missile, Air Expeditionary Force Weapon, Common Aero Vehicle, Extended Range Strike Aircraft, Hypersonic Standoff Weapon, Hypervelocity Missile, Long Range Cruise Missile, and a Robust Autonomous Attack Missile. In addition, IO capabilities, especially net warfare operations and electronic warfare, constitute a new effective tool to defeat air defenses. New capabilities to rapidly locate and target enemy air defenses, such as the fiber-optic towed decoy and advanced tactical targeting technology, are now emerging and have the potential to enable legacy fighter aircraft to contribute to this mission. The Global Strike CONOPS is designed, among other tasks, to defeat air defense systems.
- **Enhance power projection and forcible entry capabilities:** Virtually all Air Force transformational capabilities described in Chapter VII will significantly enhance power projection in some way. Stealthy platforms (such as the F/A-22), standoff weapons, IO, and UCAVs are at the heart of forcible entry capabilities. New capabilities demonstrated during Operation Iraqi Freedom include Embedded Contingency Response Groups and Expeditionary Combat Support Modules. In addition, both the Global Strike and Global Response CONOPS are designed primarily for this purpose.
- **Defeating long-range means of detection:** Relevant Air Force transformational efforts include IO (see the Information Superiority sections of Chapter VII and Appendix B for details) and space superiority (see the Space Superiority section of Chapter VII) capabilities to deny space to adversaries.

- **Long-range attack capabilities:** The Air Force is exploring a wide range of future system concepts: the Common Aero Vehicle, Hypersonic Standoff Weapon, Hypervelocity Missile, Advanced Standoff Cruise Missile, Extended Range Strike Aircraft, B-X Bomber, Hypervelocity Rod Bundles, Long Range Cruise Missile, Robust Autonomous Attack Missile, New Long-Range Platform, and, potentially, the Airborne Laser.
- **Protection measures for transport and air refueling aircraft:** The Large Aircraft Infrared Countermeasures and Advanced Situational Awareness/ Countermeasures System will enhance protection measures for air mobility aircraft.
- **Ensure US forces can sustain operations under chemical or biological attack:** Primary Air Force efforts include the Restoration of Operations ACTD and the Medical CBRNE Defense concept. Section A of this appendix discusses additional relevant efforts.
- **Defeat adversary cruise missiles:** In addition to interoperable joint C4ISR (see the Information Superiority section of Chapter VII) to rapidly locate cruise missiles, the Air Force is pursuing two key programs. The MC2A, equipped with the Multi-Platform Radar Technology Insertion Program, will increase the ability to detect, track, and identify stationary and moving ground vehicles and cruise missiles. Second, the F/A-22's highly capable radar and supercruise capabilities will enable the aircraft to track, rapidly close in, and engage enemy cruise missiles. In addition, both the Global Strike and Global Response CONOPS are designed, in part, to accomplish this mission. See Section A of this chapter and the "Missile Destruction in Flight" section of Chapter VII for more details.
- **Send well armed and logistically supported forces to critical points around the globe, even in the face of enemy opposition, or to locations where the support infrastructure is lacking or has collapsed:** Air Force efforts to develop significantly lighter, leaner, and faster combat support (see Agile Combat Support section of Chapter VII) strongly support this objective. Such enhancements are vital to enable responsive, persistent, and effective combat operations into the future. These initiatives include: Advanced Planning and Scheduling, Agile Transportation (AT 21) ACTD, Condition Based Maintenance, Future Single Supply System, Global Combat Support System–Air Force, Logistics Financial Management re-design, Supply Chain Common Operating Picture, Purchasing and Supply Chain Management, and Centralized Intermediate Repair Facilities. In the area of significantly enhancing medical support operations in a way that contributes directly to agile combat support, the Air Force is also developing the Expeditionary Medical Support system in the near-term and the following future system concepts in the long-term: Theater Medical Planning and Control System and the Ground Contingency Medical Support System. The Air Force will also develop a separate transformation roadmap for effective and efficient combat support to the new Air Force CONOPS per the new *Air Force Strategic Planning Directive for Fiscal Years 2006-2023*.

In addition, the Global Strike CONOPS will serve as the initial, leading edge force designed to conduct operations in an intense anti-access environment. It will pave the way for persistent follow-on forces by rapidly rolling back adversary anti-access threats, thereby allowing the Global Mobility CONOPS to rapidly deploy follow-on combat forces to sustain combat operations.

Finally, the Air Force, per direction by the new *Air Force Strategic Planning Directive*, will develop joint operational concepts for defeating the full range of anti-access threats, force sequencing, and reductions in the first-deployer footprint.

D. Deny enemies sanctuary by providing persistent surveillance, tracking, and rapid engagement

Adversaries will also likely seek to exploit strategic depth to their advantage. Mobile ballistic missile systems can be launched from extended range, exacerbating the anti-access and area-denial challenges. Space denial capabilities, such as ground-based lasers, can be located deep within an adversary's territory. Accordingly, a key objective of transformation is to develop the means to deny sanctuary to potential adversaries. This will likely require the development and acquisition of robust capabilities to conduct persistent surveillance, precision strike, and maneuver at varying depths within denied areas. [Page 31 of QDR]

Likely enemies of the United States and its allies will rely on sanctuaries-such as remote terrain, hidden bunkers, or civilian "shields" for protection. The capability to find and strike protected enemy forces while limiting collateral damage will improve the deterrent power of the United States and give the President increased options for response if deterrence fails. Such a capability would not only reduce the likelihood of aggression, but would offer the National Command Authorities the ability to respond immediately in the event of hostilities.

Achieving this objective will require investments in a wide range of cross-Service programs. Investments in intelligence, surveillance, and reconnaissance initiatives must be bolstered. Also emphasis must be placed on manned and unmanned long-range precision strike assets, related initiatives for new small munitions, and the ability to defeat hard and deeply buried targets.

DoD will procure unmanned combat aerial vehicles and intelligence, surveillance, and reconnaissance unmanned aerial vehicles such as Global Hawk. The Department will also increase procurement of precision weapons.

Special Operations Forces will need the ability to conduct covert deep insertions over great distances and will need enhanced C4ISR capabilities to remain in contact with their commanders and to ensure access to real-time intelligence in a number of forms. These capabilities will enable Special Operations Forces to access additional communication, intelligence, and firepower assets in support of their missions deep in hostile environments and to aid in the reduction of friendly losses and casualties. These capabilities will also enhance the strategic and operational agility of Special Operations Forces. [Page 44 of QDR]

This objective asks the Services to develop or improve the following list of capabilities, which are accompanied by brief summaries of key Air Force efforts to address them:

- **Persistent ISR:** The Air Force is pursuing various programs to conduct persistent ISR, seamlessly transition from global to focused persistent ISR, and effectively integrate and manage ISR platforms and sensors, which are all discussed in the Information Superiority section of Chapter VII and Appendix B. Key future programs to achieve persistent ISR include the Space-Based Radar and various UAVs such as Global Hawk.

- **Capability to find and strike protected enemy forces while limiting collateral damage:** A combination of virtually all Air Force efforts described in Chapter VII sections entitled Information Superiority, Precision Engagement, Standoff, and Global Attack will significantly enhance this capability. Together, they will enable the United States to almost immediately strike any target, to include mobile, hard, deeply buried, and information targets, in all weather and all-terrain before they can escape or hide. Specific programs and future system concepts are listed under other bullets in this section. Several classes of weapons not already listed in this section that would achieve this capability are various non-lethal weapons and weapons designed for urban warfare. Some examples of relevant ACTDs and future system concepts under examination are: Active Denial System ACTD, Next Generation Gunship, Advanced Tactical Laser ACTD, the Military Intelligence Tactical Element–Urban Surveyor, and the Advanced Tactical Targeting Technology ACTD. More near-term, the Air Force is developing an "Urban Target Array" and is examining the integration of manned and unmanned systems, precision terminal guidance operations, and high technology to aid joint forces on the ground within the urban environment.
- **Manned and unmanned long-range precision strike assets:** These include all the standoff weapons and global attack programs and future system concepts discussed in Chapter VII: B-X Bomber, Common Aero Vehicle, Hypersonic Cruise Vehicle, Hypervelocity Rod Bundles, New Long-Range Platform, Joint Air to Surface Standoff Missile-Extended Range, UCAVs, Advanced Standoff Cruise Missile, Air Expeditionary Force Weapon, Extended Range Strike Aircraft, Hypersonic Standoff Weapon, Hypervelocity Missile, Long Range Cruise Missile, and the Robust Autonomous Attack Missile.
- **New small munitions:** The primary ongoing Air Force effort is the Small Diameter Bomb. The Air Force is also exploring some additional miniature munition future system concepts such as the Low Cost Persistent Area Dominance Miniature Missile, Cooperative Persistent Surveillance Strike Vehicle, Air Expeditionary Force Weapon, Guardian Urban Combat Weapon, and the Wide Area Search Autonomous Attack Miniature Munition.
- **Ability to defeat hardened and deeply buried targets:** Defeating these targets will likely require a combination of new or modified, more lethal munitions utilizing advanced technologies such as thermobaric weapons that generate highly sustained blast pressures in such confined spaces as tunnels and underground facilities. These munitions release energy over a longer period of time than standard explosives, thereby creating a long-duration pressure pulse when detonated in confined spaces. Also required will be IO capabilities that can cut off power, life support, and other critical services to such targets. The Common Aero Vehicle would also be effective against these targets.
- **UAVs:** The Air Force is developing UAVs such as the Global Hawk and Predator-B (see the Information Superiority section of Chapter VII). The Air Force complements their larger system with increased emphasis on smaller systems to improve last minute target verification and "around the corner" information superiority for special forces. Such smaller UAVs include: the Desert Hawk, Force Protection Aerial Surveillance System, the Pointer UAV, and the BatCam Micro UAV, which is part of the Battlefield Air Operations Kit.

- **Ability to conduct covert deep insertions over great distances:** In the near-term, the CV-22 is the key platform under development to achieve this objective. In the longer run, the Air Force is examining a concept called the M-X, a covert transport aircraft with increased speed, range, and agility that is capable of undetected infiltration.

The Space&C4ISR CONOPS will harness Air Force capabilities to achieve horizontal integration of manned, unmanned, air, surface, information, and space systems, eventually through machine-to-machine interface of ISR and command and control, to provide executable decision-quality knowledge to the commander in near real-time from anywhere—critical to denying sanctuary to adversaries. In addition, the Global Response CONOPS will provide an integrated joint air, space, maritime ground, and IO capability to respond globally to fleeting targets using precise and decisive force in an attack window ranging from minutes to hours.

E. Enhance the capability and survivability of space systems

In addition to exploiting space for their own purposes, future adversaries will also likely seek to deny U.S. forces unimpeded access to space. Space surveillance, ground-based lasers and space jamming capabilities and proximity microsatellites are becoming increasingly available. A key objective for transformation, therefore, is not only to ensure the U.S. ability to exploit space for military purposes, but also as required to deny an adversary's ability to do so. [Page 31 of QDR]

Because many activities conducted in space are critical to America's national security and economic well being, the ability of the United States to access and utilize space is a vital national security interest. During crisis or conflict, potential adversaries may target U.S., allied, and commercial space assets as an asymmetric means of countering or reducing U.S. military operational effectiveness, intelligence capabilities, economic and societal stability, and national will. Ensuring the freedom of access to space and protecting U.S. national security interests in space are priorities for the Department.

The mission of space control is to ensure the freedom of action in space for the United States and its allies and, when directed, to deny such freedom of action to adversaries. As the foundation for space control, space surveillance will receive increased emphasis. DoD will pursue modernization of the aging space surveillance infrastructure, enhance the command and control structure, and evolve the system from a cataloging and tracking capability to a system providing space situational awareness.

In recognition of the high-technology force multipliers provided by space systems, the QDR places increased emphasis on developing the capabilities to conduct space operations. Ensuring freedom of access to space and protecting U.S. national security interests are key priorities that must be reflected in future investment decisions. [Page 45 of QDR]

The Air Force is the primary Service charged with achieving this objective. Achieving space superiority is the essential component of this objective. Space superiority combines the following three capabilities: protect space assets, deny adversaries' access to space, and quickly launch vehicles and operate payloads into space to

quickly replace space assets that fail or are damaged/destroyed. All of these depend on first establishing effective space situational awareness in order to sense and track actual threats to space assets and ascertain whether problems are actually attacks or something else. As described in Chapter VII in the Space Superiority section and the Rapid Global Mobility section (which includes rapid space launch), the Air Force is very active in developing the key capabilities required to maintain space superiority against increasing threats.

Key unclassified Air Force programs and future system concepts to establish effective space situational awareness include: Counter Surveillance and Reconnaissance System, Rapid Attack Identification Detection and Reporting System, Orbital Deep Space Imager, Space-Based Space Surveillance System, Space Tracking and Surveillance System, Compact Environmental Anomaly Sensor II ACTD, and Communication/Navigation Outage Forecasting System ACTD.

Key unclassified Air Force offensive counterspace programs that will provide combatant commanders the ability to achieve space superiority include the Counter Communication and the Counter Surveillance and Reconnaissance Systems. Future system concepts include the Counter Satellite Communications System, short pulse laser technology, the Air-Launched Anti-Satellite Missile, Ground Based Laser, Space-Based Radio Frequency Energy Weapon, and various other information operations capabilities.

Defensive Counterspace capabilities will be greatly enhanced through both a change in concepts of operations of satellite constellations as well as a fleet of active and passive defensive capabilities. The Air Force is also exploring various future system concepts to launch, operate, and maintain space assets responsively. These include: the Air Launch System, Orbital Transfer Vehicle, Space Maneuver Vehicle, Global Launch and Test Range, and the Space Operations Vehicle.

The Space Control Range will be essential to enable a full spectrum exercise and training environment for these capabilities.

F. Leverage information technology and innovative concepts to develop interoperable Joint C4ISR

Finally, new information and communications technologies hold promise for networking highly distributed joint and combined forces and for ensuring that such forces have better situational awareness–both about friendly forces as well as those of adversaries–than in the past. Information technology holds vast potential for maximizing the effectiveness of American men and women in uniform. [Page 31 of QDR]

Information technology will provide a key foundation for the effort to transform U.S. armed forces for the 21st century. The recent U.S. experience in Kosovo underscored the need for high-capacity, interoperable communications systems that can rapidly transmit information over secure, jam-resistant datalinks to support joint forces. In the near future, the United States must also develop

alternatives capable of overcoming current and projected bandwidth constraints. The Department must stay abreast of the new communications landscape and leverage it to maximize U.S. advantages in this area.

Future operations will not only be joint, but also include Reserve Components, civilian specialists, and other federal agencies and state organizations. Most likely they will involve a coalition effort with other countries. The effectiveness of these operations will depend upon the ability of DoD to share information and collaborate externally as well as internally. Interoperability, which enables joint and combined operations, is a key element in all DoD operational and systems architectures. It must include the ability to overcome language and cultural barriers. Experience shows that fixing systems after the fact to achieve interoperability is typically costly and often fails to satisfy mission requirements and creates security problems. The better approach is to incorporate interoperability at the outset in designing new systems. However, the Department will continue its efforts, where cost effective, to bring its legacy systems up to interoperability standards.

Based on QDR deliberations, funding will be focused on achieving end-to-end Command, Control, Communication, Computer, Intelligence, Surveillance, and Reconnaissance capabilities. An integrated joint and combined C4ISR capability is necessary to ensure that accurate and relevant information can be gathered swiftly from various sources and then securely transmitted to forces and their commanders. Improving communications must be a priority for U.S. conventional, special operations, and strategic forces. Information technology offers U.S. forces the potential of conducting joint operations more effectively, with smaller forces and fewer weapon systems. [Pages 45-46 of QDR]

All of the Air Force transformation efforts associated with the first three transformational capabilities described in the Information Superiority section of Chapter VII and Appendix B address this critical goal, which arguably is at the center of the US military's ongoing transformation. Those transformational capabilities include:

- Complete joint integration of all manned, unmanned, and space systems
- Real-time picture of the battlespace
- Predictive Battlespace Awareness

The Air Force is investing more than $50 billion over the FYDP in the FY04 President's Budget in joint C4ISR. Key unclassified programs and future system concepts include: Advanced Extremely High Frequency System, Airborne Networking capability, Advanced Situational Awareness/Countermeasures System, Air and Space Operations Center, Air Force Satellite Control Network upgrades, Air Force Transformation Center (formerly CAOC-X), Automated ISR, Combatant Commanders Integrated Command and Control System, Combat Information Transport System, Distributed Common Ground System, Integrated LOGCAT/GeoReach-Expeditionary Site Planning/Mapping, Enhanced Human Performance, eXtensible Markup Language, Family of Interoperable Operational Pictures (Common Relevant Operational Picture), Global Broadcast System, Global CONOPS Synchronization, Global Hawk, Global Positioning System Block IIF/III, Ground Warrior Modernization, Integrated Flight Management ATD, ISR Management capability, Integrated Broadcast Service, Joint Tactical Radio System Wideband Networking Waveform, Link-16, Multi-Platform Common Data Link, Multi-Platform Radar Technology Insertion Program, Single Integrated Air Picture, Single Integrated Space Picture, Situational Awareness Data Link Gateway, "Smart Platforms"

(including Roll-on Beyond Line of Sight Enhancement and family of Scalable, Modular, Airborne, Relay Terminals), Space-Based Radar, Supply Chain Common Operating Picture, Tactical Data Link Architecture enhancements, Transformational Communication Terminals, Transformational Satellite, Deployable Theater Information Grid, Tactical UAV Initiative (which includes the Desert Hawk, Force Protection Aerial Surveillance System, Pointer UAV, and BatCam Micro UAV), Theater Air Control System, Digital Imagery Request and Distribution System, Multi-sensor Command and Control Aircraft, and the Command and Control Constellation. The Air Force is also pursuing several related ACTDs: Network Centric Collaborative Targeting, Adaptive Battlespace Awareness, Adaptive Joint C4ISR Node, Time-Critical Targeting Functionality, and Advanced Tactical Targeting Technology. In addition, the Air Force is exploring future system concepts of biomarkers that can track individual locations (Biomarker System and Biofeedback System) and improve the cognitive performance of decision-makers (Advanced Cognitive Aid). In addition, during Operation Iraqi Freedom, the Air Component Coordination Element allowed the air component to better integrate air and space power with the operations of the other components to better achieve the Joint Force Commander's objectives.

It is important to emphasize that the Air Force is also pursuing numerous small and/or classified programs that together are essential to achieve advanced C4ISR for air, space, and ground and the horizontal integration of all C4ISR and weapons platforms.

The Air Force, as directed by the *Air Force Strategic Planning Directive for Fiscal Years 2006-2023*, will develop a master plan to achieve the horizontal integration of manned, unmanned, space, and information systems to provide decision-quality knowledge to the joint commander in near real-time.

In the area of training, Distributed Mission Operations will integrate live, virtual, and constructive aspects into a single seamless joint and coalition training environment. Through simulation, assets that are seldom available live can be incorporated into a live exercise and/or rehearsal. Connectivity to the Global Information Grid will allow LD/HD assets to participate in training, exercises, or mission operations even when those assets are not available in the area of operation.

The Space&C4ISR CONOPS is the primary concept driving the requirements of these systems. In addition, the Global Strike CONOPS includes extensive details and guidance regarding the types of capabilities required to achieve this QDR goal.

The following table maps the Air Force transformation efforts described in the Flight Plan with the QDR's six "Critical Operational Goals of Transformation." Many programs and efforts strongly support more than one QDR goal. However, given that certain analyses are sometimes forced to bin them under just one of the QDR goals, the capital "X" denotes the QDR goal under which the Air Force recommends binning the program/effort if forced to select one—based on QDR's own description of the capabilities it ties to these QDR goals. These descriptions are included earlier in this appendix.

Air Force Program/ *Future System Concept/* Effort/Organization	QDR's Six Critical Operational Goals of Transformation:					
	Address CBRNE Threat	Conduct Effective IO/IA	Defeat Anti-Access	Deny Sanctuary	Maintain Space Superiority	Interoperable Joint C4ISR
Active Denial System ACTD	x			X		
Adaptive Battlefield Awareness ACTD						X
Adaptive Joint C4ISR Node ACTD						X
Advanced Extremely High Frequency system						X
Advanced Mobility Concept Aircraft			X	x		
Advanced Mobility Tanker (KC-X)			X			
Advanced Planning and Scheduling			X			
Advanced Situational Awareness/Countermeasures System			X			x
Advanced Standoff Cruise Missile	x		X	x		
Advanced Tactical Laser ACTD	x			X		
Advanced Tactical Targeting Technology ACTD				X		x
Agile Force Accountability			X			
Agile Transportation ACTD			X			
Air and Space Expeditionary Forces	x	x	x	x	x	x
Air and Space Operations Center						X
Air Component Coordination Element						X
Air Expeditionary Force Weapon			X	x		
Air Force IO School		X				
Air Force Network Operations and Security Center		X				
Air Force Satellite Control Network upgrades						X
Air Force Transformation Center						X
Air Force WMD Emergency Response Program	X					

Air Force Program/ *Future System Concept*/ Effort/Organization	QDR's Six Critical Operational Goals of Transformation:					
	Address CBRNE Threat	Conduct Effective IO/IA	Defeat Anti-Access	Deny Sanctuary	Maintain Space Superiority	Interoperable Joint C4ISR
Air Launch System					X	
Airborne Laser	X		x			
Airborne Networking capability						X
Air-Launched Anti-Satellite Missile					X	
Automated ISR				x		X
Automatic Air Refueling			X	x		
Autonomous Approach and Landing Guidance			X	x		
Biofeedback System	x					X
Biomarker System	x					X
B-X Bomber			X	x		
C-17			X	x		
Centralized Intermediate Repair Facilities			X			
Combat Information Transport System						X
Combatant Commanders Integrated Command and Control System	x				X	x
Command and Control Constellation						X
Common Aero Vehicle	x		x	X	x	
Communication/Navigation Outage Forecasting System ACTD					X	
Compact Environmental Anomaly Sensor II ACTD					X	
Condition Based Maintenance			X			
Cooperative Persistent Surveillance Strike Vehicle	x			X		
Counter Satellite Communications System			x		X	
Counter Surveillance and Reconnaissance System		x			X	
Counterintelligence Support to Network Operations and Security Centers		X				
CV-22	x		x	X		

Air Force Program/ *Future System Concept/* Effort/Organization	QDR's Six Critical Operational Goals of Transformation:					
	Address CBRNE Threat	Conduct Effective IO/IA	Defeat Anti-Access	Deny Sanctuary	Maintain Space Superiority	Interoperable Joint C4ISR
Deployable Theater Info Grid						X
Digital Imagery Request and Distribution System (BRITE)						X
Distributed Common Ground System						X
Distributed Mission Operations and Training						X
Electronic Warfare Coordination Cell		X				
Electronic Warfare revitalization		X				
Embedded Contingency Response Groups Capability			X			
Enhanced AF PSYOP		X				
Enhanced Human Performance			X			
Evolutionary Air And Space Global Laser Engagement	X		x			
Expeditionary Combat Support Modules			X			
Expeditionary Medical Support system			X			
Extended Range Strike Aircraft			X	x		
eXtensible Markup Language						X
F/A-22	x		X			
Family of Interoperable Operational Pictures						X
Family of Small Unmanned Systems			x	X		
F-35			X			x
Force Development	x	x	x	x	x	x
Full Spectrum Threat Response	X					
Full Spectrum Threat Response Program	X					
Future Single Supply System			X			
Future Total Force			X			
Global Broadcast System						X

Air Force Program/ *Future System Concept*/ Effort/Organization	QDR's Six Critical Operational Goals of Transformation:					
	Address CBRNE Threat	Conduct Effective IO/IA	Defeat Anti-Access	Deny Sanctuary	Maintain Space Superiority	Interoperable Joint C4ISR
Global Combat Support System-AF			X			
Global CONOPS Synchronization						X
Global Hawk	x		x	X		x
Global Launch and Test Range			x	x	X	
GPS Block IIF/III						X
Ground-Based Laser					X	
Ground Contingency Medical Support System			x	X		
Ground Warrior Modernization						X
Guardian Urban Combat Weapon				X		
Hypersonic Cruise Vehicle			x	X		
Hypersonic Standoff Weapon			x	X		
Hypervelocity Missile			x	X		
Hypervelocity Rod Bundles			x	X		
Influence Operations capabilities		X				
Info Superiority Range		X				
Information warfare capabilities (numerous)		X	x	x		
Integrated Base Defense Security Systems	X					
Integrated Broadcast Service						X
Integrated Flight Management ATD			x			X
Integrated IW Training		X				
Integrated LOGCAT/ GeoReach-Expeditionary Site Planning/Mapping	x		X			
IO Career Progression		X				
IO Integration		X				
ISR Management capability						X
IW Flights		X				
IW Planning Capability		X				

Air Force Program/ *Future System Concept/* Effort/Organization	QDR's Six Critical Operational Goals of Transformation:					
	Address CBRNE Threat	Conduct Effective IO/IA	Defeat Anti-Access	Deny Sanctuary	Maintain Space Superiority	Interoperable Joint C4ISR
Joint Air to Surface Standoff Missile—Extended Range			X	x		
Joint Biological Agent Identification and Diagnostic System	X					
Joint Biological Point Detection System	X					
Joint Chemical Agent Detector	X					
Joint Chemical-Biological Agent Water Monitor	X					
Joint Container Refill System	X					
Joint GUARDIAN Program	X					
Joint Mission Planning System						X
Joint Modular Chemical-Biological Detection System	X					
Joint Service Family of Decon Systems	X					
Joint Service Installation Pilot Project	X					
Joint Service Light NBC Recon System	X					x
Joint Service Lightweight Standoff Chemical Agent Detector	X					
Joint Service Sensitive Equipment Decon System	X					
Joint Tactical Radio System Wideband Networking Waveform						X
Joint Transportable Collective Protection System	X					
Joint Warning and Reporting System	X					x
Large Aircraft Infrared Countermeasures			X			
Link-16						X
Logistics Financial Management redesign			X			
Long Range Cruise Missile			X	x		

Air Force Program/ *Future System Concept/* Effort/Organization	QDR's Six Critical Operational Goals of Transformation:					
	Address CBRNE Threat	Conduct Effective IO/IA	Defeat Anti-Access	Deny Sanctuary	Maintain Space Superiority	Interoperable Joint C4ISR
Low Cost Persistent Area Dominance Miniature Missile	x		x	X		
Medical CBRNE Defense	X		x			
Military Intelligence Tactical Element—Urban Surveyor				X		
Multi-Platform Common Data Link						X
Multi-Platform Radar Technology Insertion Program	X		x	x		x
Multi-Sensor Command and Control Aircraft	x		x			X
M-X Low Observable Advanced AF SOF Air Mobility Platform	x		x	X		
Network Centric Collaborative Targeting ACTD						X
New Combat Wing Organization			X	x		
New Long-Range Platform			X	x		
Next Generation Gunship				X		
Orbital Deep Space Imager					X	
Orbital Transfer Vehicle					X	
Precision Extended Glide Aerial Delivery System			X			
Predator B	x		x	X		
Purchasing and Supply Chain Management			X			
Rapid Attack Identification Detection and Reporting System					X	
Regional Supply Squadrons			X			
Restoration of Operations ACTD	x		X			
Robust Autonomous Attack Missile	x		x	X		
Roll-on Beyond Line of Sight Enhancement						X
Single Integrated Air Picture						X
Single Integrated Space Picture					X	

Air Force Program/ *Future System Concept/* Effort/Organization	QDR's Six Critical Operational Goals of Transformation:					
	Address CBRNE Threat	Conduct Effective IO/IA	Defeat Anti-Access	Deny Sanctuary	Maintain Space Superiority	Interoperable Joint C4ISR
Situational Awareness Data Link Gateway						X
Small Diameter Bomb				X		
Solid State Laser (100 kW)			X			
Space-Based Infrared System—High	X					
Space-Based Radar	x		x	X		x
Space-Based Radio Frequency Energy Weapon					X	
Space-Based Space Surveillance System					X	
Space Commission implementation	x	x	x	x	X	x
Space Control Range					X	
Space Maneuver Vehicle				x	X	
Space Operations Vehicle			x	x	X	
Space Tracking and Surveillance System					X	
Supply Chain Common Operating Picture			X			x
Tactical Data Link Architecture enhancements						X
Tactical UAV Initiative			x	X		
Theater Air Control System						X
Theater Medical Planning and Control System			X			
Time Critical Targeting Functionality ACTD				X		x
Transformational Communication Terminals						X
Transformational Satellite						X
Unmanned Combat Aerial Vehicles			x	X		
Wide Area Search Autonomous Attack Miniature Munition				X		

Appendix D:
BRIEF DESCRIPTIONS OF PROGRAMS, ACTDs, AND FUTURE SYSTEM CONCEPTS

Appendix D includes brief descriptions of each of the programs, ACTDs, and future system concepts (listed in italics) that the Air Force believes, based on preliminary analysis, will be likely be the key enablers of the 16 "transformational capabilities" discussed in Chapter VII. For funded programs, the descriptions include an indication of an approximate time frame in which they are expected to be completed. "Near-term" denotes between now and 2010. "Mid-term" denotes 2010-2015. "Long-term" denotes beyond 2015. These are subject to change as the new CONOPS and CRRAs mature (discussed in Chapter VI).

Air Force Program/ *Future System Concept*/ ACTD	Brief Description (Approximate Time Frame for Programs)
Active Denial System ACTD	This nonlethal antipersonnel weapon transmits high power microwave energy that is absorbed in the first layers of skin, producing a near-instantaneous, severely painful sensation. ADS will not cause long-term damage to the targets. Research is ongoing on both land and airborne variants of ADS.
Adaptive Battlespace Awareness ACTD	Will demonstrate the potential of the Global Command and Control System Common Operating Picture to provide relevant information to support situational awareness, decision-making, execution, and planning for future operations.
Adaptive Joint C4ISR Node ACTD	Will integrate, demonstrate, and transition a single, multi-mission, morphable radio frequency system that provides seamless interoperable communications, signals intelligence, electronic, and information capabilities.
Advanced Extremely High Frequency system	Will allow secure, jam-resistant, worldwide, satellite-based communications independent of ground relay stations and distribution networks.
Advanced Mobility Concept Aircraft	Would provide world wide, all-weather, high speed, direct delivery to the battlefield with a more survivable airlifter capable of airliner speed, oversized cargo, and short take off and landing coupled to Autonomous Approach and Landing Guidance. This aircraft will be able to carry the full spectrum of US Army Future Combat Systems.
Advanced Mobility Tanker (KC-X)	Would be a long-range, long-endurance tanker that can also carry significant cargo loads. Its range would allow bombers and tankers to leave CONUS simultaneously and eliminate the need to pre-deploy tankers, greatly enhancing rapid global mobility.
Advanced Planning and Scheduling	Leverages commercial best practices and commercial off-the-shelf products to provide a new collaborative, enterprise-wide process focused on translating weapon system requirements into integrated executable buy, repair, and distribution plans and schedules. Goal is to minimize maintenance downtime and improve warfighter readiness by having the right parts in the right place at the right time.
Advanced Propulsion Systems	Would provide Mobility Air Forces with advance propulsion systems featuring a quantum leap in specific fuel consumption of hydro-carbon based fuels, far greater ranges with less reliance upon tanker forces, and significant increases in the efficiencies of rapid mobility capability.
Advanced Situational Awareness/ Countermeasures System	Is the Air Force's long-term vision for enhanced situational awareness, threat detection, and radio frequency countermeasures and threat mitigation for mobility assets to help enable mobility assets into defended areas. The system will include on board Precision Location and Identification Radar Warning Receivers and an open architecture for off-datalinks (Link-16, etc.), on- and off-board radio frequency warning systems, and countermeasures to defeat radio frequency missile engagements. The system features an EW processor to fuse (machine-to-machine) all data into actionable information for a 'two pilot' crew.

Air Force Program/ *Future System Concept*/ ACTD	Brief Description (Approximate Time Frame for Programs)
Advanced Standoff Cruise Missile	Would provide persistent air-to-ground operations beyond the range of enemy IADS. It would utilize a Global Positioning System/Inertial Navigation System to ensure precision strike and receive mission updates and course correction information from off-board sensors. A laser radar search sensor would enhance target identification. Its stealthy airframe and advanced target identification system would provide a huge tactical advantage.
Advanced Tactical Laser ACTD	Will demonstrate a high-energy laser weapon system for precision tactical airborne applications. This laser will provide warfighters with ultra precision and the ability to manage precise effects on an operator's target of choice. It will have a range of more than 10 km and a one second-to-kill capability.
Advanced Tactical Targeting Technology ACTD	By sharing the measurement of radar signals, this ACTD will leverage data from any airborne platforms, such as fighters, to detect and locate enemy surface-to-air radars to an accuracy of 50 meters, from 50 miles away, and within ten seconds after the enemy's radar turns on. This would enable transformational persistent ISR capabilities to the battlespace without reliance on current high-density, low-demand platforms. Using data links to connect them to strike platforms, every sensor would become a shooter or linked to a shooter.
Agile Force Accountability	Would significantly improve force accountability through the development of a single software suite and classified database (along with scanner technology) for deployed military personnel.
Agile Transportation (AT 21) ACTD	ACTD sponsored by US Transportation Command that will demonstrate total visibility of all transportation requirements, available lift assets, personnel, and equipment moving to and within the various theaters of operation. Advanced scheduling decision support tools will be used for mode determination and optimization of intertheater lift assets, resulting in reduced force closure times and a smaller theater logistics footprint.
Air and Space Operations Center	The Air Force has designated the Air and Space Operations Center as a weapon system to provide the Joint Force Air and Space Component Commander a standardized capability to command and control air and space forces. This action will greatly enhance horizontal integration and provide a much-improved capability to support joint operations with planning, tasking, command and control, data fusion, and near real-time common operating pictures of the battlespace.
Air Expeditionary Force Weapon	Would be a small, low cost standoff weapon using the Small Diameter Bomb concept with a 250 pound warhead and 500 nautical mile range that could be launched from a variety of platforms.
Air Force Network Operations and Security Center	Will provide a single command and control authority over information flow in AF by uniting the nine MAJCOM Network Operations and Security Centers. It will provide AF one organization to handle both service specific and joint computer responsibilities.
Air Force Satellite Control Network upgrades	The Air Force Satellite Control Network provides the earth and space connections required to launch, initialize, operate, and maintain all military satellites and recover critical warfighter data. It is being significantly enhanced over the next ten years to provide DoD-level network assured access from distributed users to and from space assets with a new dual band capability for the widest compatibility among all DoD space systems.
Air Force Transformation Center	Previously, an AOC used its own unique hardware, software, and servers that were often incompatible with other systems in other AOCs. The Air Force Transformation Center (formerly the CAOC-X) will ensure that the latest new technologies to achieve the capability to provide the commander a clear, coherent, real-time picture of the battlespace are incorporated into the global and theater AOCs in a timely and standardized manner.
Air Force WMD Emergency Response Program	This pilot program provides selected bases with WMD equipment, training and exercises. The program is designed to enhance cooperation/coordination between key players from the base and federal/state/local/host nation emergency responders. (Near-term)
Air Launch System	Would be a dedicated, all azimuth, weather avoiding, on-demand (within 48 hours) system capable of launching a Space Maneuver Vehicle, Common Aero Vehicle, or a Conventional Payload Module.

Air Force Program/ *Future System Concept*/ ACTD	Brief Description (Approximate Time Frame for Programs)
Airborne Active Denial System	Will be an airborne application of the Active Denial System for special operations and other missions.
Airborne Laser	Will use a high-energy laser mounted on a modified 747 aircraft to destroy ballistic missiles in their boost phase (currently under control of the Missile Defense Agency).
Airborne Networking capability	Enables access to unclassified and classified email, shared files, and applications hosted on their home station networks as well as view live TV and participate in secure video teleconferences from airborne platforms. The intent is to provide an "office in the sky" and extend the Global Information Grid into the airborne platforms. US senior leadership enjoys this capability at present. The Air Force intends to expand this capability to more airborne platforms.
Air-Launched Anti-Satellite Missile	Would be a small air-launched missile capable of intercepting satellites in low earth orbit.
Automated ISR	Will use technology to automate the TPED process to speed the delivery of finished intelligence to the user. It includes upgrades such as Distributed Ground System Block 20 upgrades, Network Centric Collaborative Targeting, Link-16, Automated Geo-Precise-Positioning of sensors, and Computer Aided Target Detection. (Near-term)
Automatic Air Refueling	Will permit the refueling of manned as well as unmanned air vehicles on fueling tracks obscured by clouds. This would ensure that mobility, strike, and ISR operations would not be degraded by weather in refueling areas.
Autonomous Approach and Landing Guidance	Will enable mobility operations to be conducted regardless of weather conditions and independent of ground based navigation aids by allowing mobility aircraft to land on normal surfaced runways as well as unimproved landing zones in adverse weather (to include smoke, fog, rain, and snow) conditions.
Biofeedback System	Would provide real-time vital sign information to individuals, first aid givers, and medical personnel to enable rapid self-aid and buddy care and triage of casualties entering the medical system.
Biomarker System	Would track individual location and vital signs to reduce fratricide, rapidly recover ill or injured airmen, and detect potentially harmful exposures.
B-X Bomber	Would be a stealthy long-range, supersonic bomber with a 5000 nautical mile unrefueled range.
C-17	The C-17 has transformed the way the Air Force does mobility by blending strategic and tactical airlift missions into one to better support the warfighter. It can also fly intercontinental missions, operate into short, semi-prepared landing zones, move patients, outsized cargo, and complete airdrops. Equipped with defensive systems, it can move cargo and passengers over long and short distances, from ports of embarkation directly to assault zones in the battle area—avoiding the delays associated with transferring cargo to theater airlift aircraft for final delivery to the combat forces.
Centralized Intermediate Repair Facilities	Key element of the agile combat support strategy to significantly improve support to warfighting commanders. Regional repair facilities are established based on critical needs to reduce deployment footprint, increase deployment flexibility and speed, and reduce overall maintenance manpower requirements.
Combat Information Transport System	Will provide a network centric, fiber-optic system to move, process, and protect all Air Force information. (Ongoing effort starting in the near-term and continuing into the long-term)
Combatant Commanders Integrated Command and Control System	Will provide the command and control of current and future space forces and space situation awareness via the Space common operational picture. (Near-term)
Command and Control Constellation	Will enable the horizontal integration of ground, air, and space sensors and battle management platforms such as strike aircraft and ground troops. (Mid-term)

Air Force Program/ *Future System Concept*/ ACTD	Brief Description (Approximate Time Frame for Programs)
Common Aero Vehicle	Will be an unpowered, maneuverable, hypersonic glide vehicle deployed from a possible range of delivery vehicles such as an expendable or reusable small launch vehicle to a fully reusable Space Operations Vehicle. It will guide and dispense conventional weapons, sensors, or other payloads worldwide from and through space within one hour of tasking. It would be able to strike a spectrum of targets, including mobile targets, mobile time sensitive targets, strategic relocatable targets, or fixed hard and deeply buried targets. The Common Aero Vehicle's speed and maneuverability would combine to make defenses against it extremely difficult. (Mid-term)
Communication/Navigation Outage Forecasting System ACTD	Will demonstrate the ability to combine data from ground- and sea-based sensors to provide real-time products predicting when ionospheric disturbances will affect satellite communications and navigation systems, which will help distinguish between an attack on space systems and natural phenomenon.
Compact Environmental Anomaly Sensor II ACTD	Will demonstrate the ability of on-board space environment sensor suites to reduce satellite downtime and assist in ruling out hostile attack as the cause of satellite malfunction and provide warnings of dangerous space environment conditions.
Condition Based Maintenance	A new support concept that would exploit engineering and technical knowledge combined with actual failure experience and condition data that would move toward predictive maintenance practices vice reactive practices. Key to this capability are a robust systems engineering process, exploitation tools based on the EDW, serial number tracking of key components, and on board diagnostics.
Cooperative Persistent Surveillance Strike Vehicle	Would be a light weight search and destroy system to perform near all-weather surveillance and attack.
Counter Satellite Communications System	Will provide the capability to deny and disrupt an adversary's space-based communications and early warning. (Near-term)
Counter Surveillance and Reconnaissance System	Will provide offensive counterspace counter surveillance/reconnaissance weapon acquisition program to deny, disrupt, and degrade adversary space-based surveillance and reconnaissance systems. (Near-term)
CV-22	Will rapidly insert large numbers of special operations forces or other small units over long distances with its high speed and unique capabilities. (Near-term)
Deployable Oxygen System	Will dramatically reduce the footprint of medical expeditionary forces by eliminating the need to resupply liquid oxygen to deployed medical forces. (Near-term)
Deployable Theater Information Grid	Will operate as a deployable, mobile information dissemination grid generating increased combat power through information superiority by integrating networks, sensors, decision-makers, and shooters. It will also enable commanders to dynamically plug and play sensors, engagement systems, weapons, command and control, and support capabilities into task-organized packages across the combat theater. (Mid-term)
Deployment Readiness System	Web-based solution to significantly reduce deployment scheduling time, track personnel training requirements and status, and facilitate the management of Unit Type Code qualification throughout the Air Force.
Digital Imagery Request and Distribution System (BRITE)	Will give U.S. forces national and theater imagery faster. (Mid-term)
Distributed Common Ground System	Will be an open architecture, network-centric system that will enable the support of multiple, simultaneous, worldwide operations from in garrison and through scalable, modular system deployments. It will be interoperable with spaceborne, airborne, and surface ISR collection assets and intelligence producers and it will be able to access intelligence databases from these ISR resources to optimize ISR capabilities. As a key component of the GIG, this system will provide the backbone through which disparate ISR assets will be horizontally integrated. It will transform the Air Force's ISR infrastructure to a net-centric enterprise. (Near-term)
Enhanced Human Performance	Would significantly improve cognition, strength, endurance, and perception of individuals.

Air Force Program/ *Future System Concept*/ ACTD	Brief Description (Approximate Time Frame for Programs)
Evolutionary Air and Space Global Laser Engagement (EAGLE) Airship Relay Mirrors	Will significantly extend the range of both the Airborne Laser and Ground-Based Laser by using airborne, terrestrial, or space-based lasers in conjunction with space-based relay mirrors to project different laser powers and frequencies to achieve a broad range of effects from illumination to destruction.
Expeditionary Medical Support System	Would significantly increase the theater preventive, primary, and emergent care capabilities of expeditionary medical platforms and systems while dramatically reducing airlift requirements and the theater medical footprint.
Extended Range Strike Aircraft	Would be a modified 747-400 capable of standoff strikes against hardened and deeply buried targets while beyond the range of theater air defenses as well as counter-CBRNE and SEAD missions. A simultaneous attack by 20 aircraft could destroy 1500 targets in less than 15 minutes.
eXtensible Markup Language	Will be a key enabler to the free exchange of information between systems and their associated databases. (Near-term)
F/A-22	In addition to its revolutionary first-look, first-launch, and first-kill air-to-air capabilities, the F/A-22's combination of all-aspect stealth, supercruise speed, and integrated avionics that enable it to engage mobile ground targets in any weather will be essential for the United States to penetrate the next two generations of rapidly advancing enemy air defenses and clear the way for follow-on joint forces day or night. These capabilities will also track, rapidly close in, and engage enemy cruise missiles. The F/A-22 is also pioneering the capability for one platform to connect all the links the "kill chain": find-fix-track-target-engage-assess. Its on-board sensors and communications systems will detect and track enemy systems, allowing immediate self-targeting or engagement by other platforms that receive the battlespace picture on a shared network, followed by an immediate assessment of effects. (Near-term)
Family of Interoperable Operational Pictures	A joint program with new funding provided by OSD that will close the seams between existing legacy C4ISR systems and extend the capability of systems under development in order to exploit the full data collection and management abilities of current C4ISR assets. Its goal is to achieve a Common Relevant Operational Picture: an all-source picture of the battle space containing actionable, decision-quality, information to the warfighter through a fusion of existing databases. It will achieve this by implementing data sharing and fusion among heterogeneous, stovepiped systems in support of both operational and tactical users. It will facilitate establishment of interoperability standards and architectures to guide future acquisitions. (Near-term)
Family of Small Unmanned Systems	Will provide Special Tactics personnel increased battlespace awareness through employment of small, tactical UAVs. (Near-term)
F-35	The F-35 will be a new fighter aircraft that has transformational sensor capability that enables non-traditional ISR and sensor integration that will help enable the transformational capabilities of machine-to-machine integration and real-time picture of the battlespace. It also will possess low-observable characteristics that will enable persistent combat air support over the future battlefield. Furthermore, F-35 will help enable the negation of advanced enemy air defenses because it will possess the ability to perform unrestricted operations within heavily defended airspace. (Mid-term)
Full Spectrum Threat Response	Program will be how the AF will plan for, respond to, and begin recovery from full spectrum threats at the installation and MAJCOM level. It includes program elements such as Terrorist Weapons of Mass Destruction Response; the Weapons of Mass Destruction Pilot Installation Program; Joint Service Installation Pilot Program/ Guardian; Hazardous Material Emergency Response; Nuclear, Biological, Chemical, and Conventional Defense; and non-Medical CBRNE defense. (Near-term)
Full Spectrum Threat Response Program	This program includes policy and guidance to help commanders confront the full spectrum of physical threats and provide for the protection of installation resources. It captures the complete incident response cycle, from planning to response and recovery. It includes guidelines for training, exercising, equipping, and assessing the installation's capability for successful operations. It provides the Air Force approach to planning, organizing, training, and equipping personnel and protecting the critical infrastructures needed to accomplish the mission for the possibility of a nuclear, biological, chemical, or conventional enemy attack, major accident, natural disaster, or terrorist use of weapons of mass destruction. (Near-term)

Air Force Program/ *Future System Concept/* ACTD	Brief Description (Approximate Time Frame for Programs)
Future Single Supply System	Would reengineer the AF supply processes to leverage commercial best practices and enterprise systems. Goal would be to replace 76 current supply or supply related systems and enable single entry, instantaneous common operating picture and real time visibility over all AF supply assets worldwide.
Global Broadcast System	Will provide a true global and fully mobile communications architecture to DoD operators. Its satellite-based (Ka-band) architecture transcends previous geographic limitations to allow relatively high bandwidth transmission of mission critical data to forces virtually anywhere in the world with relative simplicity. (Near-term)
Global Combat Support System-AF	Delivers real-time, worldwide asset, equipment, and weapon system status. Deployed troops have praised the Air Force logistics capabilities on the portal and said that it is the only way they have had asset visibility and access to their logistics applications at bare base locations. The fleet asset status tool provides real-time status of aircraft worldwide, with drill-down capabilities for parts and maintenance status. Additional capabilities and tools continue to be added through spiral development. (Near-term)
Global CONOPS Synchronization	Will demonstrate ability to and benefits of sharing real-time information among Mobility Air Force (global) and Combat Air Force (multi-area of responsibility centric) command and control planning and execution systems and flying assets via machine-to-machine data exchange.
Global Hawk	The Global Hawk is a high endurance UAV with an ISR payload for intercontinental coverage. When combined with the continuous global access of Space-Based Radar and near real-time data transfer to multiple relevant command and control elements, the Global Hawk will allow constant imaging or tracking of relevant mobile or fixed surface targets in any weather conditions. (Near-term)
Global Launch and Test Range	Would broaden the region over which the launch and test ranges are able to execute Telemetry, Tracking, and Commanding during spacelift operations as well as test and evaluation activities. It will also support the current military spaceplane plan calling for launches from the interior of the US, away from the coasts. Would provide necessary Command and Control for the Space Maneuver Vehicle and the Space Operations Vehicle. Would be a key enabler of responsive launch and operation of new space vehicles and refueling/repair of existing vehicles.
GPS Block IIF/III	Will greatly expand current GPS navigation and targeting capabilities and enhance its jam-resistance in conjunction with anti-jam margins provided by user equipment. (GPS IIF is near-term; GPS III is mid-term)
Ground Based Laser	Would propagate laser beams through the atmosphere to Low-Earth Orbit satellites to provide robust defensive and offensive space control capability.
Ground Contingency Medical Support System	Would significantly increase the preventive, primary, emergent care, and mass casualty management capabilities of individual ground medical systems.
Ground Warrior Modernization	Will standardize (with special forces) and significantly improve the equipment used by Tactical Air Control Parties (ground spotters for air strikes), who are critical enablers of time-critical targeting and timely close air support in many instances.
Guardian Urban Combat Weapon	Would be an air launched lurk and loiter reconnaissance, rotary winged, unmanned, combat air vehicle designed for urban warfare.
High Powered Microwave Airborne Electronic Attack	Will develop and demonstrate an anti-electronics high powered microwave weapon against “soft” electronic-containing targets from an airborne platform at military significant ranges.
Hypersonic Cruise Vehicle	Would operate like an aircraft from conventional runways within the CONUS and reach time-critical targets up to 9,000 nautical miles away within two hours with payloads up to 12,000 pounds.
Hypersonic Standoff Weapon	Would be an air-launched, deep-strike weapon capable of delivering munitions and unitary warheads. Missile launch would be subsonic, typically at altitudes between 30,000-40,000 feet. It is expected to travel up to 1000 nautical miles and then deploy submunitions (e.g., WASAAMM or Small Diameter Bomb) or perform direct attack.
Hypervelocity Missile	Would be an air-launched missile that travels at hypersonic speeds with 1000 nautical miles of range. It would provide a rapid response capability against high-value and emerging targets, arriving at its target in less than 30 minutes from maximum range.

Air Force Program/ *Future System Concept*/ ACTD	Brief Description (Approximate Time Frame for Programs)
Hypervelocity Rod Bundles	Would provide the capability to strike ground targets anywhere in the world from space.
Integrated Base Defense Security Systems	A wide range of offensive and defensive capabilities associated with the new Integrated Base Defense and Force Protection CONOPS that include new sensors, command and control systems for a common operating system, and a suite of remotely operated sensors, weapons, and robotics.
Integrated Broadcast Service	Would facilitate the provision of instant access to complete, accurate, and timely tactical intelligence and targeting information while supporting battle managers, intelligence centers, air defenders, fire support elements, and aviation nodes for airborne, sea-going, subsurface, and ground mobile platforms.
Integrated Flight Management ATD	The IFM-ATD technology development effort is a multi-part process ultimately designed to enhance current and future command and control systems used by flight managers, planners, and schedulers. Objectives of this effort include developing the methodology for accomplishing intelligent search, retrieval and storage of mission planning data used by Air Force planners and schedulers, the improvement of Air Mobility Command's flight planning system, and the optimization of current and future command and control capabilities within Air Mobility Command and other major commands.
Integrated LOGCAT/ GeoReach-Expeditionary Site Planning/Mapping	Will provide a common process and operational picture for planning Air Force expeditionary operations. Leverages commercial off the shelf products to provide detailed tabular and geospatial data on potential operating locations and calculates combat support capability requirements for planners at all levels—to include CBRNE vulnerability assessments.
ISR Management capability	Will enable the operators and collections managers in the AOC to visualize the status and capabilities of ISR assets in the area of operations and dynamically retask them in near real-time based on battlefield activity. (Near-term)
Joint Air to Surface Standoff Missile-Extended Range	Will be a stealthy precision cruise missile designed to launch from outside area defenses to kill a wide variety of targets, including hardened targets, both fixed and mobile. It will extend the current production Joint Air-to-Surface Standoff Missile range from 200 nautical miles to over 500 nautical miles. (Near-term)
Joint Biological Agent Identification and Diagnostic System	A three-block program for a reusable, portable, modifiable biological agent identification and diagnostic system for simultaneous, reliable identification of multiple biological warfare threat agents. Block I: analytical device, device consumables, and protocols for identification of ten biological warfare threat agents/ten biological agents of operational significance. Block II produces capability to identify five toxins. (Near-term)
Joint Biological Point Detection System	Active laser system that will detect biological organisms from 3-15 kilometers and discriminate biological warfare organisms from naturally occurring biological organisms from 1-3 kilometers. (Near-term)
Joint Chemical Agent Detector	Point detector for chemical agents/toxic industrial chemicals that allows for masking prior to symptom on-set. (Near-term)
Joint Chemical-Biological Agent Water Monitor	A portable water agent sample/detection device that allows the user to sample with the device for chemical and biological agents as well as chemical and biological agents as well as toxic industrial chemicals and materials. (Near-term)
Joint Container Refill System	Simple-to-operate system capable of refilling containers such as canteens and five-gallon water cans with water in the nuclear, biological, and chemical environment; compatible with a variety of water distribution systems. (Near-term)
Joint GUARDIAN Program	Program replaces the Joint Service Installation Pilot Program and expands the former program from nine to 200 installations (64 Air Force). This approximately $1 billion program is designed to beef up chemical, biological, radiological, and nuclear protection at military installations worldwide. (Near-term)
Joint Mission Planning System	Will replace older, stove-piped, costly-to-maintain systems now used by the Services with a standardized, plug-and-play, user-friendly joint mission planning capabilities to support tomorrow's warfighter.
Joint Modular Chemical-Biological Detection System	Combined lightweight, handheld chemical, biological, and Toxic Industrial Materials detector or network of detectors capable of detecting, identifying, quantifying, and warning of hazards. (Mid-term)

Air Force Program/ *Future System Concept/* ACTD	Brief Description (Approximate Time Frame for Programs)
Joint Service Family of Decon Systems	A four-block strategy that groups decontamination for non-personnel items, applicators, casualties/personnel, and emerging technology integration and provides a means to remove, neutralize, or eliminate CBRNE and toxic hazards. (Near-term)
Joint Service Installation Pilot Project	Congressionally mandated program implemented through Program Budget Decision 289, dated 10 Dec 2001. The program is designed to enhance the counter-CBRNE capabilities of nine DoD Installations, three per Service. The approach is to provide equipment and training solutions tailored to each installation and evaluate the improvement in capability. The Air Force has designated Robins, Barksdale, and Pope Air Force Bases. (Near-term)
Joint Service Light NBC Recon System	HMMWV-based collective protective system with a suite of nuclear chemical and biological legacy and standoff detectors designed for mobile reconnaissance/ surveillance and marking. (Near-term)
Joint Service Lightweight Standoff Chemical Agent Detector	Provides passive standoff detection capability for chemical agents/toxic industrial chemicals and detect-to-warn capability. It allows for masking prior to symptom on-set. (Near-term)
Joint Service Sensitive Equipment Decon System	System block approach allows decontamination of sensitive equipment, i.e., avionics, electrical, electronic, and environmental systems, then aircraft/vehicle interiors, and associated cargo while in-flight or during ground/shipboard operations without degradation. (Near-term)
Joint Tactical Radio System	A joint program in which the Air Force participates, it will provide a software reprogrammable joint Services radio and data transmission system. (Near-term)
Joint Transportable Collective Protection System	Contamination Control Area module, Toxic Free Area module and capability to collectively protect fixed facilities; provides protection from chemical and biological warfare agents and toxic industrial chemicals. (Near-term)
Joint Warning and Reporting System	A network link for all nuclear, biological, and chemical detectors with all nuclear, biological, and chemical and reporting echelons warning. It provides defense planning and toxic industrial chemical event plotting and reporting. (Near-term)
Large Aircraft Infrared Countermeasures	Will defend US cargo, tanker, and other heavy aircraft from attack by infrared missiles and greatly enhance the ability to defeat anti-access strategies. (Near-term)
Link-16	Provides jam-resistant, secure communications that can be relayed over long distances for integrated operations and supports the concept of machine-to-machine interface for horizontal integration. It is currently being installed in attack aircraft beginning with the F-15 and F-16 Blocks 40/50. The goal is to put Link 16 on all attack aircraft enabling digital interface with command and control aircraft and a variety of joint command and control ground forces. (Near-term)
Logistics Financial Management redesign	Would reengineer the Air Force logistics financial operations from a unit-based, transaction-dominated financial environment to a more centralized enterprise-wide resource construct. The goal would be to manage and control costs across the enterprise to improve overall warfighter support while reducing costs.
Long-Range Cruise Missile	Would be a stealthy, air-launched cruise missile designed to accommodate multiple, independently targetable conventional warheads that can strike well defended targets greater than 2000 nautical miles away.
Low Cost Persistent Area Dominance Miniature Missile	Would be a light-weight search and destroy system in which up to 16-36 missiles would join to form a cooperative grid to detect and destroy time critical targets under most weather conditions.
Medical CBRNE Defense	Would provide significantly enhanced CBRNE prophylaxis, identification/detection, medical surveillance, and casualty treatment capabilities.
Military Intelligence Tactical Element—Urban Surveyor	Would add to overall urban situational awareness by looking into individual structures and determining as best as possible the internal layout of the structure and the activity of people inside the structure as well as match individuals with those on a database. It could also attack targets in those structures with a 300 kilowatt laser.

Air Force Program/ *Future System Concept*/ ACTD	Brief Description (Approximate Time Frame for Programs)
Multi-Platform Common Data Link	Will be a critical network-enabled wideband link for the Multi-Platform Radar Technology Insertion Program and the Network Centric Collaborative Targeting ACTD. (Near-term)
Multi-Platform Radar Technology Insertion Program	Will greatly increase the Air Force's ability to detect, track, and identify stationary and moving ground vehicles. (Near-term)
Multi-Sensor Command and Control Aircraft	Will enhance the capabilities of Joint Surveillance Target Attack Radar System and the Airborne Warning and Control Systems as well as various other signals intelligence and command-and-control aircraft. It will provide Ground Moving Target Indicator capabilities along with focused Air Moving Target Indicator capabilities for Cruise Missile Defense. The aircraft will be a key node of the Command and Control Constellation. (Mid-term)
M-X Low Observable Advanced AF SOF Air Mobility Platform	A conceptual aircraft required to support and improve SOF rapid, global mobility beyond 2015. The M-X would defeat sophisticated integrated air defense systems with low-observable/stealth design technology and/or active signal management combined with advanced air defense electronic countermeasures for increased survivability. It would need to deliver and recover personnel and equipment deep in hostile, denied, or politically sensitive airspace while maintaining the critical elements of tactical surprise and speed. It also would require "agility in the objective area" or ultra short takeoff and landing or vertical capability.
Network Centric Collaborative Targeting ACTD	Will demonstrate a network centric operating system designed to horizontally integrate air, space, and surface ISR assets at the digital level and dramatically reduce the time required to detect, identify, locate, and designate fleeting targets.
New Long-Range Platform	Would be a modified, wide-bodied aircraft that could launch 40 long-range conventional cruise missiles and/or standoff hypervelocity missiles. In a permissive environment, it could penetrate enemy airspace and drop various PGMs. It would be able to reach 97 percent of the countries of the world from CONUS with one aerial refueling or one stopover without entering hostile territory. It requires no in-theater basing and can be refueled at nearly any large airfield.
Next Generation Gunship	Would provide persistent application of tailored precision firepower to defeat, destroy, disperse, and deny using lethal and/or non-lethal means. Its utility would be measured by its ability to integrate lethality, connectivity, and survivability through a persistent presence to achieve the desired effects.
Orbital Deep Space Imager	Will provide a predictive, near real-time common operating picture of space to enable space control operations. (Mid-term)
Orbital Transfer Vehicle	Would significantly increase the flexibility, warfighting utility, and protection of US space assets while enabling on-orbit servicing of those assets.
Precision Extended Glide Aerial Delivery System	Would be a fast, worldwide logistics support system with minimum inventory, response time, and manpower. It has a global range (9-12,000 nautical miles) with payloads of 150,000 to 250,000 pounds and is air refuelable. It could make precision airdrops and would have advanced counter-measure capability to do rapid resupply in hostile territory. It would be able to serve as the primary supply system for ground troops, replacing ground vehicles.
Predator B	An updated version of the Predator UAV that would used as a UCAV to strike time sensitive targets.
Purchasing and Supply Chain Management	Will reengineer Air Force supply chain processes to incorporate commercial best practices and integrate the purchasing and supply processes into a single end-to-end enterprise process that significantly reduces supply chain operating costs and improves war fighter readiness.
Rapid Attack Identification Detection and Reporting System	A family of systems that will provide the capability to automatically identify when a space system is under attack. (Near-term)

Air Force Program/ *Future System Concept/* ACTD	Brief Description (Approximate Time Frame for Programs)
Regional Supply Squadrons	Key element of the agile combat support strategy to significantly improve support to warfighting commanders. Regional supply squadrons are established based on critical needs to reduce deployment footprint, improve spares command and control, and reduce overall supply manpower requirements.
Restoration of Operations (RestOps) ACTD	An ACTD designed to help fixed military sites, such as air bases, protect against and recover from the consequences of chemical or biological attacks. The five-year ACTD is divided into two phases, a three-year demonstration phase, recently completed, followed by a two-year transition phase. During the first phase, the ACTD demonstrated improved chemical and biological defense technologies and operational procedures.
Robust Autonomous Attack Missile	Would be an air-launched interdiction weapon that would provide autonomous, stand-off capability against a variety of mobile land and sea targets. Different versions under consideration could carry small diameter bombs, SEAD micro missiles, or surveillance equipment.
Roll-on Beyond Line of Sight Enhancement	The first in a family of Scalable, Modular, Airborne, Relay Terminals, which will reside on tankers, but will also be suitable for a variety of other platforms to include unmanned and ground or sea-based vehicles. Initially, it will be a Link-16 relay that will allow line-of-sight and beyond line-of-sight communication of participants in the network. It will become a vital part of a global network to provide critical data to warfighters more quickly for faster decision-making and time sensitive engagement of critical targets. Informally referred to as "Smart Tanker." (Near-term)
Single Integrated Air Picture	Will provide improved air awareness in the battlespace to the warfighter, reduce or eliminate the potential for fratricide due to inaccurate targeting information, and significantly enhance the Air Force's ability to conduct effects-based operations through the employment of weapons to their designed capability. (Near-term)
Single Integrated Space Picture	Will provide the "space picture" part of the Family of Interoperable Operating Pictures. (Near-term)
Situational Awareness Data Link Gateway	When combined with Near-Term Enhancements to the Tactical Data Link Architecture, will allow greater numbers of combat aircraft to access a wider variety of Air Force and Navy platforms from Active, Guard, and Reserve components to improve the sensor-to-shooter kill chain timeline. (Near-term)
Small Diameter Bomb	Will enable strike aircraft to carry far more PGMs per sortie. For example, a B-52 that can drop 12 2000 pound Joint Direct Attack Munitions today will be able to drop more than 100 small diameter bombs against multiple targets. It will also enable smaller platforms such as UCAVs to deploy PGMs and increase the F/A-22's effectiveness by enabling it to carry many PGMs internally so it can remain stealthy and perform the transformational capabilities of the Global Strike CONOPS. (Near-term)
Solid State Laser (100 kW)	Will enable several shots of high-energy laser per minute on fighters, bombers, transports, etc. (Mid-term)
Space-Based Infrared System—High	Will be key to enabling the transformational ability to defend the United States against ballistic missile attack by greatly enhancing ballistic missile detection. (Near-term)
Space-Based Radar	Will provide the capability to look deeply and persistently into areas that are inaccessible to current platforms due to political restrictions, geographical constraints, or the technological limitations of legacy systems. The continuous global access of SBR and the extended-loiter capability of the UAV, combined with near real-time data transfer to multiple relevant command and control elements, will allow constant imaging or tracking of all relevant mobile or fixed surface targets in any weather conditions in all types of terrain as well as within urban areas. (Long-term)
Space-Based Radio Frequency Energy Weapon	Would be a constellation of satellites containing high-power radio-frequency transmitters that possess the capability to disrupt/destroy/disable a wide variety of electronics and national-level command and control systems. It would typically be used as a non-kinetic anti-satellite weapon.
Space-Based Space Surveillance System	Will be a constellation of optical sensing satellites to track and identify space forces in deep space to enable offensive and defensive counterspace operations. (Near-term)

Air Force Program/ *Future System Concept*/ ACTD	Brief Description (Approximate Time Frame for Programs)
Space Control Range	Will enable a full spectrum exercise and training environment in realistic "battlefield" conditions and augment existing DoD range infrastructure and supports combined air, space, sea, and land. (Near-term)
Space Maneuver Vehicle	Would be a rapidly reusable orbital vehicle deployed from the Space Operations Vehicle or Evolved Expendable Launch Vehicle that is capable of executing a wide range of space control missions.
Space Operations Vehicle	Would enable an on-demand spacelift capability with rapid turn-around, multiple standardized payloads, space vehicle maintenance, ISR, offensive and defensive counterspace, and space surveillance capabilities. The Space Operations Vehicle would also be one of the vehicles that would deploy the Common Aero Vehicle.
Space Tracking and Surveillance System	Will develop a series of interoperable research and development satellites and supporting ground equipment for the detection and tracking of ballistic missiles (formerly Space Based Infrared System-Low). (Near-term)
Supply Chain Common Operating Picture	Will integrate all supply chain information to provide a common operational view of Air Force supply chain to the manager, customers, and warfighting commanders. Establishes framework for e-procurement and future enterprise ERP migration.
Tactical Data Link Architecture enhancements	When combined with Situational Awareness Data Link Gateway will allow greater numbers of combat aircraft to access a wider variety of Air Force and Navy platforms from active, guard and reserve components to improve the sensor-to-shooter kill-chain timeline. (Near-term)
Tactical UAV Initiative	Will embed a small tactical UAV squadron within Air Force Special Operations Command to improve support to the special operations missions and support to joint warfighting. Such smaller UAVs include: the Desert Hawk, Force Protection Aerial Surveillance System, the Pointer UAV, and the BatCam Micro UAV, which is part of the Battlefield Air Operations Kit. (Near- to mid-term)
Theater Air Control System	Will be an open-architecture, Defense Information Infrastructure Common Operating Environment-compliant network capable of serving all command and control mission applications. (Long-term)
Theater Medical Planning and Control System	Would link theater surveillance, aeromedical evacuation, planning, and response capabilities to regional, coalition, and joint health support system.
Time Critical Targeting Functionality ACTD	Will demonstrate the ability to provide commanders the manpower and equipment necessary to more effectively strike critical fixed and mobile targets.
Transformational Communication Terminals	Key enabler of the Advanced Wideband System. (Near-term)
Transformational Satellite	Will provide greatly expanded bandwidth and secure communications. (Near-term)
Unmanned Combat Aerial Vehicle	The Air Force is pursuing several UCAV platforms. They are highly survivable and scaleable attack aircraft with selected specific capabilities for lethal and non-lethal suppression of enemy air defenses as well as strike missions. The Air Force is also considering a limited near-term electronic attack capability for them and studying the longer-term potential to integrate directed energy and precision, all-weather capabilities. (Near-term)
Wide Area Search Autonomous Attack Miniature Munition (WASAAMM)	Would be a miniature smart cruise missile with the ability to loiter over and search for a specific target, significantly enhancing time-critical targeting of moving or fleeting targets. When the target is acquired, WASAAMM can either attack or relay a signal to obtain permission to attack. Due to its very small size, the WASAAMM has stealth qualities.

Appendix E:
HOW THE AIR FORCE SUPPORTS THE TRANSFORMATION PLANS OF THE OTHER SERVICES

As described in Chapter III, the Services already strongly support each other across many areas. However, for each Service to enable its transformation plans, they need additional support from the other Services. These needs are described in each Service's 2003 transformation roadmaps (for the Air Force, see the end of Chapter VII). This appendix describes relevant Air Force efforts that would help enable transformation plans of the other Services. This appendix, when combined with similar efforts in the other Service roadmaps, is intended to provide an initial starting point to help evaluate Service interdependencies–a key OSD goal of the Service transformation roadmaps articulated in the TPG. Once the JOCs are completed, they will provide a detailed common framework to enable DoD to more comprehensively assess Service interdependencies.

The left column of the table below includes a list of broad needs the Army, Navy, and Marines have of the other Services and Agencies to enable their transformation plans based on preliminary drafts of their 2003 transformation roadmaps and coordination with their roadmap authors. They are organized under the five Joint Warfighting Capability Assessments. Those needs required by more than one Service are colored blue. Navy-Marine Corps' needs are in lighter gray and the Army's are in darker gray. The right column lists relevant unclassified Air Force efforts that would likely help address the needs of the other Services. In some cases, it refers to specific sections of the Flight Plan that describe relevant Air Force efforts in detail. Appendix D includes descriptions of most of the programs, future platform concepts, and ACTDs described here.

Service Needs of other Services/ Agencies to Enable Transformation Plans	Relevant Air Force Efforts to Address Need
Battlespace Awareness	
Enhanced, robust, timely, persistent ISR easily accessible by all	Distributed Common Ground System, Automated ISR, Global Broadcast System, UAVs, ISR Management capability, Integrated Broadcast Service, Multi-Platform Radar Technology Insertion Program, Adaptive Battlespace Awareness ACTD, Digital Imagery Request and Distribution System, Family of Interoperable Operational Pictures (Common Relevant Operational Picture)
Command and Control	
Increased range and bandwidth of satellite communications	Laser communications, Advanced Extremely High Frequency, Transformational Satellite
Time critical strike—to include joint fire control system of systems (any Service sensor/spotter can direct fires from any Service platform)	Virtually all efforts described in "Information Superiority" section of Chapter VII and Appendix B will help enable time critical strike. The following efforts would most directly support a "joint fire control system": Joint Tactical Radio System, Link-16, Situational Awareness Datalink Gateway, Tactical Data Link Architecture Enhancements, Command and Control Constellation, Multi-Sensor Command and Control Aircraft, Deployable Theater Information Grid, Network Centric Collaborative Targeting ACTD, Time Critical Targeting Functionality ACTD.

Service Needs of other Services/ Agencies to Enable Transformation Plans	Relevant Air Force Efforts to Address Need
Jointly developed C4ISR systems to satisfy all Service requirements and ensure COP and interpretation of processed info. Includes following joint protocols and standards.	Air Force agrees that jointly developed communications and information systems to satisfy all Services' requirements and to ensure common operational picture and interpretation of processed information. All Services should jointly pursue common hardware and software development to ensure interoperability and to reduce development, procurement, and overall Operation and Maintenance costs.
Force Application	
Coordinated IO efforts—to include assured communications	The Services have been taking various steps to improve IO coordination.
Operational fires	See Chapter VII sections on Precision Engagement and Global Attack. Also see Chapter III for Army-Air Force efforts to improve combat air support.
Tactical fires	See Chapter VII sections on Precision Engagement. Also see Chapter III for Army-Air Force efforts to improve combat air support.
Complementary tactical maneuver	
Proliferation of cheap precision munitions	
Space defense/anti-satellite systems	See Chapter VII section on Space Superiority
Logistics	
Collaborative enroute planning capabilities for strategic airlift assets	The Air Force components from US Transportation Command, European Command, and Pacific Command assist US Transportation Command to ensure that en route infrastructure and capabilities exist to provide timely support to the warfighter.
Integrated joint logistics support both to and from the sea base	The Air Force is currently supporting the Unified Course effort between the Navy and JFCOM exploring the Sea Basing Concept
Strategic airlift for rapid arrival and assembly of forces in theater	See "Rapid Global Mobility" section of Chapter VII. The Mobility Requirements Study and ongoing US Transportation Command transportation request prioritization balance and impact demands on air mobility.
Logistics demand reduction	See "Agile Combat Support" section of Chapter VII
Casualty evacuation capabilities	
Operational/tactical airlift (shallow-draft fast sealift, advanced theater airlifter such as SSTOL or HLVTOL)	Advanced Mobility Concept Aircraft
Capability to deploy from secure bases in US or forward locations by sea via unimproved or even impaired transportation nodes (and explore artificial port capability). Includes JSEAD and Aerial Port of Debarkation.	See "Rapid Global Mobility" section of Chapter VII
Protection	
Coordinated missile defense capabilities and tracking data	Air Force agrees coordinated missile defense networks are needed. More specifically, the Air Force needs information from the Army Patriot PAC-3 (AN/MPQ-53 radar); Navy Aegis (AN/SPY-1 radar), Cobra Judy, and Cobra Gemini; and Marines TPS-59v3. Additional coordination required with the Federal Aviation Administration, Coast Guard, and Aerostat.
Cooperation from USCG, law enforcement, and international organizations for force protection	N/A

Acronyms

ACCE	Air Component Coordination Element
ACTD	Advanced Concept Technology Demonstration
AEF	Air and Space Expeditionary Force
AETF	Air Expeditionary Task Force
AF-DCGS	Air Force Distributed Common Ground System
AMMP	Air Mobility Master Plan
AOC	Air Operations Center
ATD	Advanced Technology Demonstration
BMMP	Business Management Modernization Program
BMSI	Business Modernization and Systems Integration
BRAC	Base Realignment and Closure
C4ISR	command, control, communications, computers, intelligence, surveillance, and reconnaissance
CAOC	Combined Air Operations Center
CBRNE	chemical, biological, radiological, nuclear, and high explosive
CCIC2S	Combatant Commanders Integrated Command and Control System)
CONOPS	concept(s) of operation
CONUS	continental United States
CRRA	Capabilities Review and Risk Assessment
DoD	Department of Defense
DOTMLPF	doctrine, organization, training, materiel, leadership and education, personnel, and facilities
DPG	Defense Planning Guidance
EBO	effects-based operations
EPV	Enterprise Process View
FTF	Future Total Force
FYDP	Future Years Defense Plan
GIG	Global Information Grid
GPS	Global Positioning Satellite
HLS	homeland security
HPM	high powered microwave
IEC	Infrastructure Executive Council
IO	information operations
IP	Internet Protocol
IPv6	Internet Protocol version 6
IW	information warfare
JEFX	Joint Expeditionary Force Experiment
JFCOM	Joint Forces Command

JOC	Joint Operating Concept, Joint Operations Center
JOpsC	Joint Operations Concepts
JSTARS	Joint Surveillance Target Attack Radar System
JTRS	Joint Tactical Radio System
LD/HD	low density/high demand
M&S	modeling and simulation
MAJCOM	Major Command
MC2A	Multi-Sensor Command and Control Aircraft
MCO	Major Combat Operation
OIF	Operation Iraqi Freedom
OSD	Office of the Secretary of Defense
PA&E	Program Analysis and Evaluation
PBA	Predictive Battlespace Awareness
PGM	precision-guided munition
POM	Program Objective Memorandum
PSYOP	psychological operations
QDR	Quadrennial Defense Review
RDT&E	research, development, testing and evaluation
RMA	Revolution in Military Affairs
S&T	science and technology
SAM	surface-to-air missile
SBIG	Senior Business Modernization and Systems Integration Group
SEAD	suppression of enemy air defenses
SOF	special operations forces
TENCAP	Tactical Exploitation of National Capabilities
TPED	Tasking, Processing, Exploitation, and Dissemination
TPFDD	Time-Phased Force Deployment Document
TPG	Transformation Planning Guidance
UAV	unmanned aerial vehicle
UCAV	unmanned combat aerial vehicle
UCC	Unified Combatant Commander
US	United States
WASAAMM	Wide Area Search Autonomous Attack Miniature Munition
WF HQ	Warfighting Headquarters
WNW	Wideband Networking Waveform
XML	eXtensible Markup Language

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